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Water Quality Modeling of Reservoir System Operations Using HEC-5

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WATER QUALITY MODELING
OF RESERVOIR SYSTEM OPERATIONS
USING HEC-5

R.G. WILLEY

SEPTEMBER 1987

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WATER QUALITY MODELING
OF RESERVOIR SYSTEM OPERATIONS
USING HEC-5

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CHAPTER I

INTRODUCTION

The U.S. Army Corps of Engineers is responsible for the operation of hundreds of multiple purpose reservoirs in addition to maintenance of hundreds of miles of non-reservoir projects (e.g., levees and navigation channels). Management of reservoir releases for water quality can be analyzed to determine the operation with any one of the numerously available reservoir computer programs [WRE 1969a, HEC 1972, U.S. Army 1977, HEC 1978, Loftis 1980]. With river water quality programs, the impact of specified reservoir releases can be evaluated at downstream points of interest [HEC 1978].

The problem with using single project models is the difficulty of coordinating releases among projects which impact on a single location. This is particularly obvious in Figure 1 where the operation of both reservoirs A and B impact on the amount and quality of water at City A (i.e., control point 3). As the system is expanded further downstream, the computations necessary to provide a best operation of reservoirs A through D for control point 7 obviously require a comprehensive system approach.

The "HEC-5, Simulation of Flood Control and Conservation Systems, Appendix on Water Quality Analysis" computer model [HEC 1986] has been developed specifically for evaluating the type of problem shown in Figure 1. The model is capable of evaluating a reservoir system of up to ten reservoirs and up to thirty control points. The model will determine a best system operation for water quantity and quality; evaluating operational concerns like flood control, hydropower, water supply, and irrigation diversions. Changing needs and natural inputs can also be accommodated.

The HEC-5 water quality routines can be used to determine the quality constituents available with the best system water quantity operation or alternately the best water quality operation. The model can analyze water temperature, up to three conservative and three non-conservative constituents, dissolved oxygen and phytoplankton. Optional computation intervals from hourly to monthly are available. Graphical post-processor capability can be interfaced through other available software.

This training document provides guidance on the application of the HEC-5 computer program to a typical water quality study. The purpose of this training document is to familiarize the first time user of HEC-5 with the procedure to follow for collecting, assembly, and manipulating water quality input data. The optional types of executions and the proper interpretation of results are also discussed at some length. The author conveys many significant items not normally discussed in a users manual or even in short course lectures. These items resulted from experience gained by completing several studies with this water quality model.

Following the procedures in this document will help the reader apply HEC-5 to routinely encountered problems involving evaluation of water quality conditions in existing and/or proposed multipurpose reservoir systems.

The HEC-5 water quality model is new and therefore a research tool until it has been successfully applied to numerous practical problems. The HEC would appreciate your comments and observations which could be added to this report or to the users manual regarding experiences with the application of HEC-5. As desirable improvements are identified, modifications will be made.

Additional assistance in understanding HEC-5 is available by contacting Mr. Willey at (916) 551-1748 or (FTS) 460-1748.

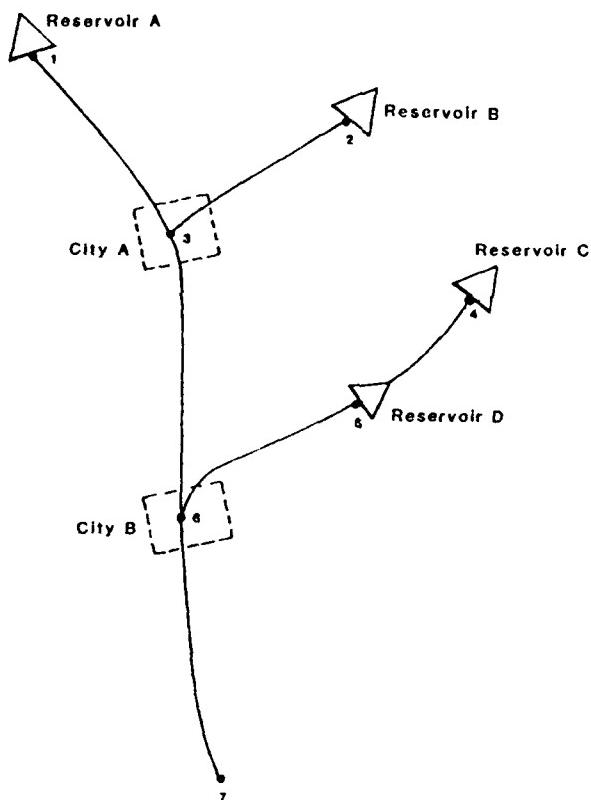


Figure 1
TYPICAL RESERVOIR SYSTEM SCHEMATIC

CHAPTER II

MATHEMATICAL MODEL

The mathematical model, "HEC-5, Simulation of Flood Control and Conservation Systems, Appendix on Water Quality Analysis," has been used to analyze the Sacramento Valley [Willey 1985], Kanawha River Basin [Willey 1986], and the Monongahela River Basin [Willey 1987] Reservoir Systems. The computer program Users Manual [HEC 1986], and several technical papers [Duke 1984, Willey 1982, 1983, 1984, and 1987] adequately document the details of the model concepts and the input description, so only a brief overview is provided in this chapter.

The HEC-5 water quality computer program is composed of a flow simulation module (HEC-5A) and the water quality simulation module (HEC-5Q). They are an integrated package with feedback capability between the two modules. Each module, the gate selection routine and the flow alteration option are described below.

Flow Simulation Module

The flow simulation module was developed to assist in planning studies for evaluating proposed reservoirs in a system and to assist in sizing the flood control and conservation storage requirements for each project recommended for the system. The program can be used in studies made immediately after the occurrence of a flood to show the effects of existing and/or proposed reservoirs on flows and damages in the system. The program should also be useful in selecting the proper reservoir releases throughout the system during flood emergencies in order to minimize flooding as much as possible and yet empty the system as quickly as possible while maintaining a balance of flood control storage ("balanced pool") among the reservoirs.

The above purposes are accomplished by simulating the operation of a system of reservoirs of any configuration for short interval historical floods or for long duration nonflood periods or for combinations of the two. Specifically the program may be used to determine:

- a. Flood control and conservation storage requirements for each reservoir in the system.
- b. The influence of a system of reservoirs on the spatial and temporal distribution of runoff in a basin.
- c. The evaluation of operational criteria for both flood control and conservation (including hydropower) for a system of reservoirs.
- d. The expected annual flood damages, system costs, and system net benefits for flood damage reduction.
- e. The system of existing and proposed reservoirs or other alternatives that result in the maximum net flood control benefits for the system by making simulation runs for selected alternative systems.

Water Quality Simulation Module

The water quality simulation module was developed to simulate temperature, as well as three user-selected conservative and three user-selected non-conservative constituents. The model also allows dissolved oxygen to be simulated if the user selects either carbonaceous or nitrogenous oxygen demanding constituents. An option for phytoplankton evaluation is also available.

The water quality simulation module accepts system flows generated by the flow simulation module and computes the distribution of all the water quality constituents in each of the reservoirs in the system and their associated downstream river reaches. The reservoirs may be in any arbitrary parallel and tandem configuration.

The water quality simulation module also selects the gate openings for reservoir selective-withdrawal structures to meet user-specified water quality objectives at downstream control points. If the objectives cannot be satisfied with the previously computed "balanced pool" flows, the model will compute a modified flow distribution necessary to better satisfy all down-stream objectives. With these capabilities, the planner may evaluate the effects of proposed reservoir-stream system modifications on water quality and determine how a reservoir intake structure should be operated to achieve desired water quality objectives within the system.

Each reservoir is assumed to be a control point, in keeping with the concepts used in the development of the flow simulation module. Additional control points may be placed in the stream system below the reservoirs at stream confluences and any other desirable locations.

Computational time steps from hourly to monthly are optional. The model is limited to simulations of one calendar year.

The reservoirs are represented by a series of one-dimensional horizontal elements such as those shown in Figure 2. Each horizontal element is characterized by an area, thickness and volume. In the aggregate, the assemblage of layered volume elements is a geometric representation of the prototype reservoir. This one-dimensional representation has been shown to represent adequately water quality conditions in many deep, well stratified reservoirs by Eiker [US Army 1977], Baca [1977] and Water Resources Engineers [1968, 1969a, 1969b].

Each horizontal layer is assumed to be completely mixed with all isopleths parallel to the water surface both laterally and longitudinally. External inflows and withdrawals occur as sources or sinks within each layer and are instantaneously dispersed and homogeneously mixed throughout each element from the headwaters of the impoundment to the dam. It is not

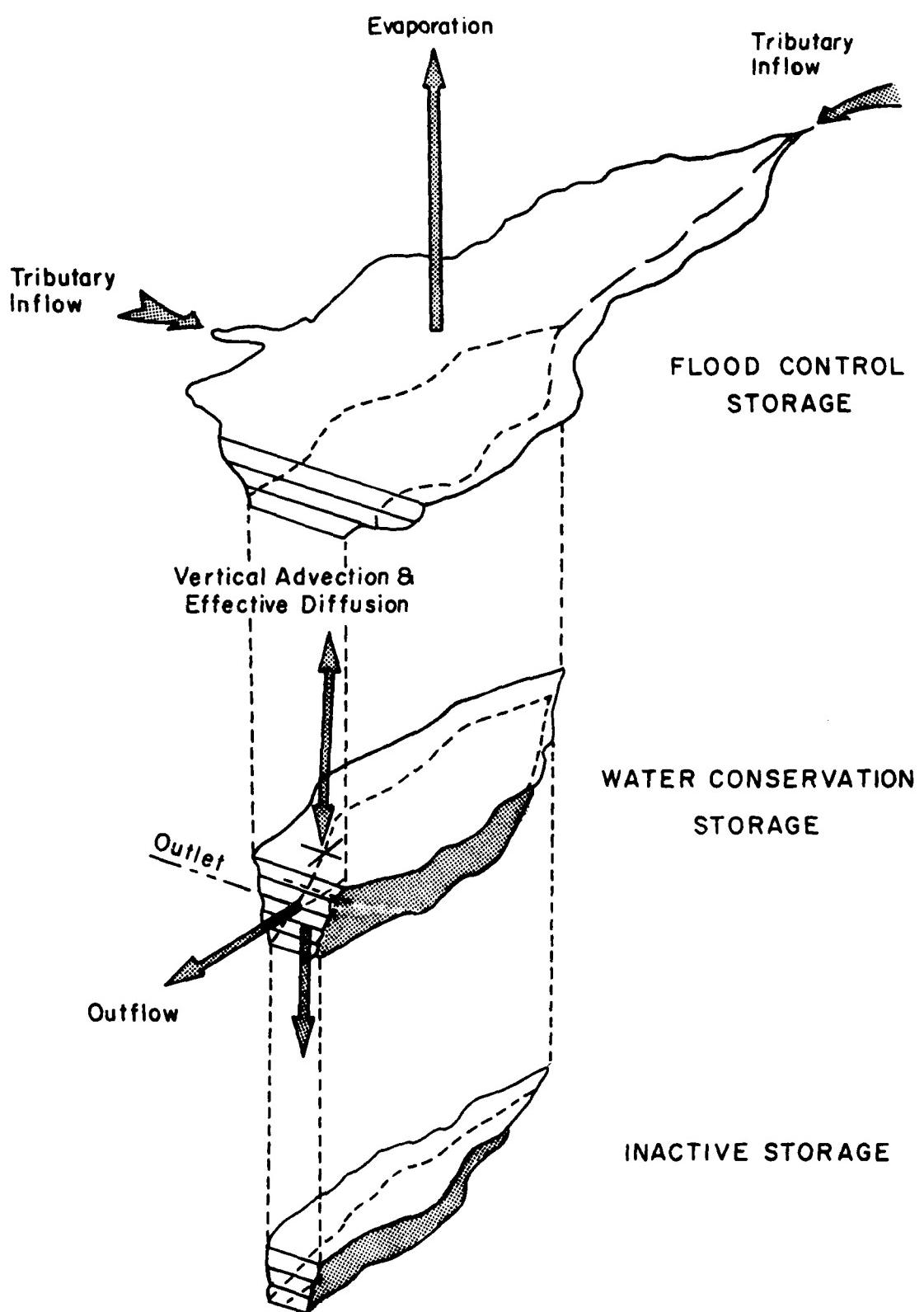


Figure 2
GEOMETRIC REPRESENTATION OF A STRATIFIED RESERVOIR
AND MASS TRANSPORT MECHANISM

possible, therefore, to model longitudinal variations in water quality constituents. Simulation results are most representative of conditions in the main reservoir body.

Vertical advection is governed by the location of inflow to, and outflow from, the reservoir. Thus the computation of the zones of distribution and withdrawal for inflows and outflows are of considerable significance in operation of the model. The WES withdrawal method [Bohan 1973] is used for determining the allocation of outflow. The Debler inflow allocation method [Debler 1959] is used for the placement of inflows.

Vertical advection (physical movement of mass due to continuity balance) is the net interelement flow and is one of two transport mechanisms used in the module to transport water quality constituents between elements. Effective diffusion is the other transport mechanism. The effective diffusion is composed of molecular and turbulent diffusion and convective (physical movement of water due to density instability) mixing.

Wind and flow-induced turbulent diffusion and convective mixing are the dominant components of effective diffusion in the epilimnion of most reservoirs. In quiescent, well-stratified reservoirs, molecular diffusion may be a significant component in the metalimnion and hypolimnion. For deep, well-stratified reservoirs with significant inflows to or withdrawals from the hypolimnion, flow induced turbulence in the hypolimnion dominates. For weakly stratified reservoirs, wind induced or wind and flow induced turbulent diffusion will be the dominant component of the effective diffusion throughout the reservoir. One of two methods may be selected by the user to calculate effective diffusion coefficients. For shallow weakly stratified reservoirs, the wind controlled mixing [HEC 1978] method is appropriate, while the stability method [HEC 1978] is more appropriate for deeper well stratified reservoirs. Both of these methods have been shown in numerous applications to adequately represent the mixing phenomena for heat and dissolved water quality constituents when properly applied.

The stream system is represented conceptually as a linear network of segments or volume elements as shown in Figure 3. Each element is characterized by length, width, cross-sectional area, hydraulic radius, energy slope, Manning's n, and a flow and depth relationship. Flow rates at stream control points are calculated within the flow simulation module using any one of the several programmed hydrologic routing methods. Within the flow simulation module, incremental local flows (i.e., inflow between adjacent control points) are assumed to be located at the nearest control point.

Within the water quality simulation module, the incremental local flow may be divided into components and placed at different locations within the stream reach (i.e., that portion of the stream bounded by the two control points). A flow balance is

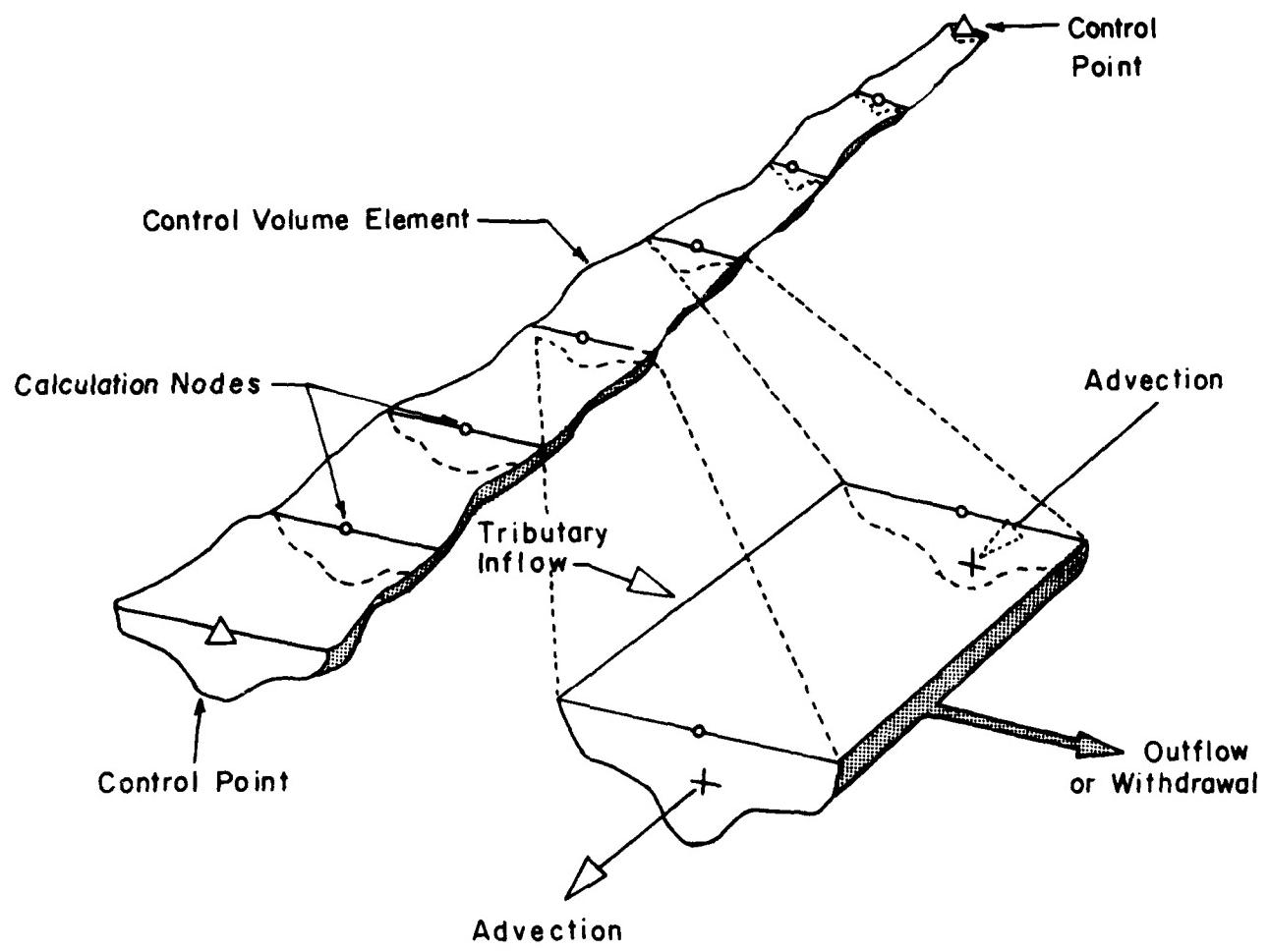


Figure 3

GEOMETRIC REPRESENTATION OF STREAM SYSTEM AND
MASS TRANSPORT MECHANISM

used to determine the flow rate at element boundaries. Any flow imbalance (i.e., the difference in the flow at the upstream control point plus all tributary inflows and the flow at the downstream control point) is distributed uniformly to the flows at each element boundary. Once interelement flows are established, the depth, surface width, and cross sectional area are computed at each element boundary either by using the input flow-depth relationship or by assuming normal depth.

Gate Selection Routine

Once the desired reservoir release and the target water quality to meet downstream needs has been computed, the gate selection algorithm determines which ports should be open and what flow rate should pass through each open port in order to maximize a particular function of the downstream water quality target concentrations. Solution of this problem is accomplished by using mathematical optimization techniques. The objective function is related to the target downstream target qualities subject to various types of constraints at the individual ports.

The reservoir intake structure can have up to two wet wells, containing up to eight intake ports, and a flood control outlet. It is assumed that releases through any of these ports (including the flood control outlet) leave the reservoir through a common pipe. At any given time, only one port in either wet well and the flood control outlet may be operated. Hence, the algorithm provides flows through three ports at most.

The HEC-5 model also provides for releases through an uncontrolled spillway. These releases are not a part of the gate selection algorithm, but the water quality of the spillway releases are considered by the gate selection algorithm.

The algorithm proceeds by considering a sequence of problems, each representing a different combination of open ports. For each combination, the optimal allocation of total flow to ports is determined. The combination of open ports with the highest water quality index defines the optimal operation strategy for the time period under consideration.

There are four different types of combinations of open ports. For one-port problems, all of the flow is taken from a single port and the water quality index is computed. For two-port problems, combinations of one port in each wet well and combinations of each port with the flood gate are considered. For three-port problems, combinations of one port in each wet well and the floodgate are considered. The total flow to be released downstream is specified externally to the gate selection routine, but if the flow alteration option is selected, then the flow can be treated as an additional decision variable and the flow for which the water quality index is maximized is also determined.

For each combination of open ports, a sequence of flow allocation strategies is generated using a gradient method, a gradient projection method, or a Newton projection method as appropriate. The value of any flow allocation strategy is determined by evaluation of a water quality index subject to the hydraulic constraints of the system. The sequence converges to the optimal allocation strategy for the particular combination of open ports. These problems are solved very efficiently by using mathematical optimization techniques that take advantage of the problem structure, namely a quadratic objective function with linear constraints.

Flow Alteration Routine

The flow alteration routine is designed to change the reservoir releases, computed by the flow simulation module, to better satisfy the stream control point water quality objectives. Timing of intervening tributary inflows are considered. Second order effects, such as reaeration and external heating due to increased or decreased stream surface area, are not included.

The calculation procedure for the flow alteration option is as follows:

1. The relative mass of a water quality parameter being simulated that needs to be added to the flow at the control point (for those constituents below the target) or reduced in the flow at the control point (for those constituents above the target) is computed.
2. The average reservoir release concentration is computed for all reservoirs for which the constituent concentration in the releases is greater than the target concentration at the control point of interest (for those constituents below the target) or for which the constituent concentration in the releases is less than the target at the control point of interest (for those constituents above the target).
3. The total dilution flow requirement is then computed by dividing the result of step 1 by the result of step 2 to provide the total flow release needed to bring the constituent concentration at the control point of interest to the target.
4. The flow is then apportioned to the reservoirs capable of bringing the control point constituent concentration to the target in proportion to the flows originally computed for those reservoirs by the flow simulation module.

Thus the flow alteration requirement can be computed for each control point and for each constituent. The various computed flow rates are then combined by using the coefficients of a linear programming objective function and the deviation of the respective constituent concentrations from the target concentrations at each respective control point.

Once the flow augmentation requirement is determined, the flow simulation module is recalled and the computations for flow and water quality are repeated for the final results.

Summary

HEC-5 model is capable of simulating the water quality effects of the operation of a system of reservoirs. Each reservoir may be operated to satisfy a number of objectives, including flood control, low-flow, hydropower production, water supply and water quality control. The water quality portion of the model simulates temperature and eight water quality constituents including dissolved oxygen and phytoplankton. The model will determine the water quality needed from all reservoir releases to meet specified downstream water quality objectives and will determine the gate openings in each reservoir that will yield the appropriate reservoir release water quality. Should it be necessary, flows will be altered to ensure that downstream water quality objectives are met. The model selects the "best" solution for the system-wide reservoir operation.

CHAPTER III

RESERVOIR SYSTEM DESCRIPTION

The Sacramento Valley reservoir system consists of four major reservoirs as shown in Figure 4. Shasta and Keswick are tandem reservoirs in parallel with Oroville and Folsom Reservoirs. Numerous tributaries and irrigation diversions are involved.

Shasta and Keswick Reservoirs are located on the Sacramento River in northern California in the northern end of the Sacramento Valley about 240 river miles north of Sacramento. Keswick is a reregulation reservoir designed to even-out the daily hydropower releases from Shasta. Below Shasta and above Keswick, inter-basin water transfers enter the Sacramento River through Spring Creek. Along the Sacramento River, Cow Creek and Cottonwood Creek are major inflowing tributaries and the Anderson-Cottonwood, Tehama-Colusa, Corning and Glenn-Colusa Irrigation District Canals are major irrigation diversions.

Oroville Reservoir is located on the Feather River in the Sierra foothills about 95 river miles north of Sacramento. Major tributaries entering the Feather River include the Yuba and Bear Rivers. Major diversions are located immediately below Oroville Dam from the Thermalito Afterbay. The Feather River flows into the Sacramento River near Verona.

Folsom Reservoir is located on the American River in the Sierra foothills about 30 miles east of Sacramento. The American River below Folsom Reservoir is leveed with no major tributaries entering before its confluence with the Sacramento River at Sacramento (I Street).

The Sacramento River continues to flow south towards the San Francisco Bay via the Sacramento and San Joaquin Delta. This study's lower boundary is located near Hood about 20 miles south of Sacramento and just upstream of the Delta's maze of interconnected waterways.

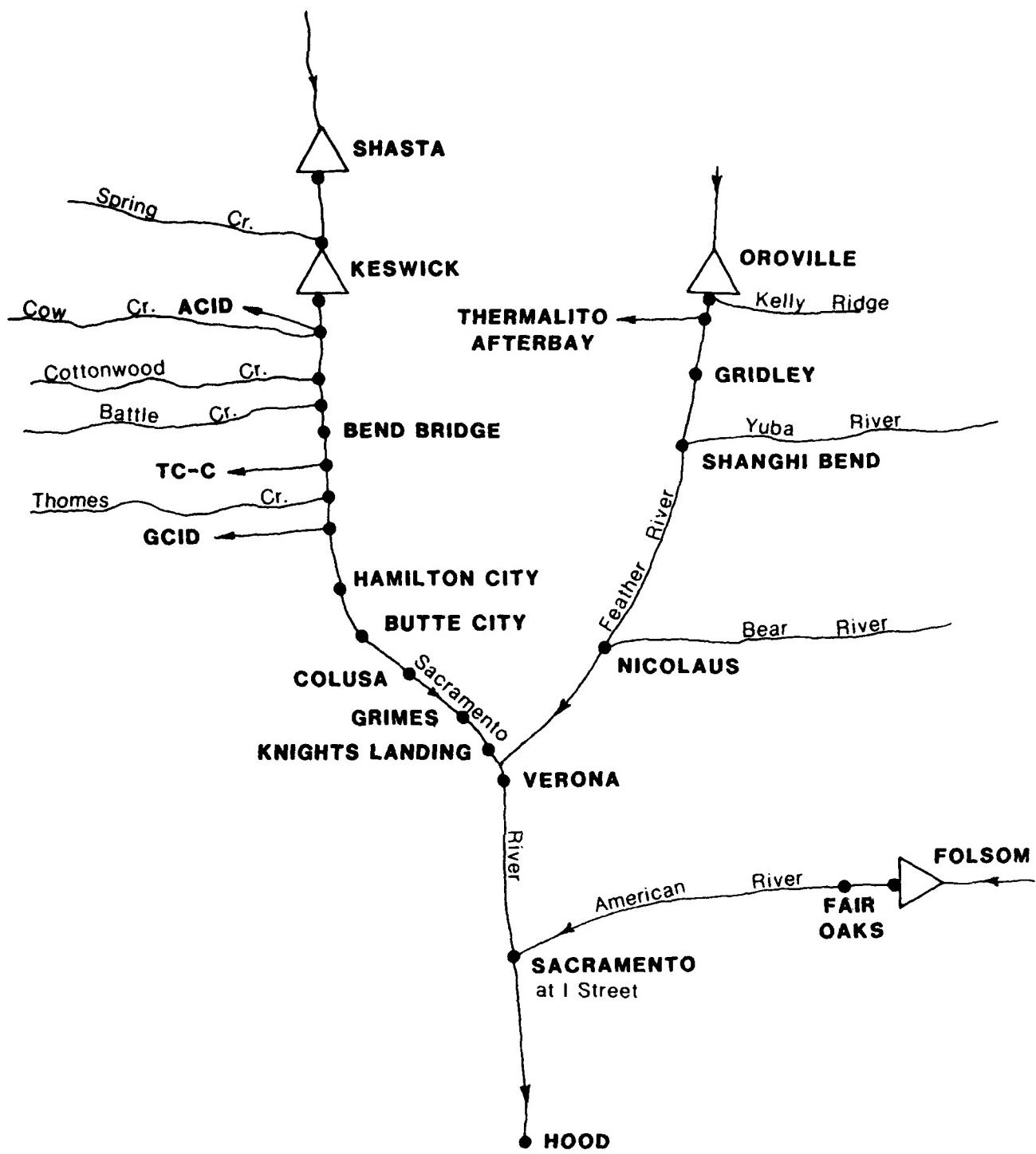


Figure 4

SACRAMENTO VALLEY RESERVOIR SYSTEM SCHEMATIC

CHAPTER IV

APPLICATION PROCEDURE

The application of the HEC-5 to the Sacramento Valley reservoir system, described in Chapter III, or to any other system begins with data collection, assembly, and manipulation. Each of these tasks in addition to model execution is discussed below. Interpretation of results is discussed in Chapter V.

Data Collection

The HEC-5 model data requirements are similar to those of most comprehensive water quality models. The data to be collected are categorized into three types; time independent, required time dependent and optional time dependent.

The time independent data include: physical description of the reservoir (i.e., elevation vs. volume, surface area and discharge capacity; and vertical reservoir segmentation), physical description of the river (i.e., river mile vs. cross section and channel discharge capacity; and river reach segmentation), control point desired and required flows, model coefficients (i.e., flow routing; reservoir diffusion; physical, chemical and biological reactions rates) and initial conditions for the start of the simulation. The input data for the Sacramento Valley reservoir system is shown in Appendix A. The time independent data for the water quantity input are on the RL, RO, RS, RQ, RA, RE, R2, CP, ID and RT records. For the water quality input, the time independent data are on L1, L2, LR, L3, L6, L7, L8, PL, L9, Cl, C2, C5, C6, C7, SA, DK, CR, S1, S2, SR, S3, S4 and KR records.

The required time dependent data include: evaporation, wind speed, cloud cover, air temperature, dew point temperature, flow diversions, inflow quantity and quality for all reservoir and river tributaries, discharge quantity from reservoirs, and control point target water quality conditions. The time dependent data are on the R3, IN, QA and QD records for the water quantity input. The input for the water quality portion are on the EZ, ET, CT, I2 and I4 records.

The optional time dependent data include: reservoir storages; river flows at other than control points; and reservoir water quality profiles and river time series plots. These data are used as checks (using auxillary graphics programs) on the model output in contrast to the previously mentioned data which are required to make the model work. This data is referred to as calibration data.

Data Assembly

Sources for the data categorized above are numerous. In general, they include all water-related agencies at the federal, state, local and private levels. To name a few, the following should all be considered when searching for data:

Corps of Engineers (COE)
Bureau of Reclamation (BUR)
Geological Survey (USGS)
Environmental Protection Agency (EPA)
state departments of natural resources
state environmental protection agencies
state colleges and universities
city and county public works offices
utility, water and flood control districts

Meteorological data (dry bulb temperature, dew point temperature, cloud cover and wind speed) are readily available from the U.S. Weather Service, local airports and universities. The primary data source for Corps of Engineers offices is the U.S. Air Force Environmental Technical Applications Center (OL-A USAFETAC) and for other offices is the NOAA's National Weather Service (NWS) office; both in Asheville, North Carolina. They should be contacted early in the data assembly task, and an order should be placed for the required meteorological data. Normally it will take 30 to 60 days to receive the data after the request is made. This data service is free to the Corps of Engineers and is documented in Department of Army Pamphlet 115-1. It is recommended that data format CD 144 be requested from OL-A USAFETAC at (FTS) 672-0218 or NWS at (704) 259-0682.

Data Manipulation

For simplification, the meteorological data should be reformatted with the "Weather" computer program [HEC 1986] and then input to the "Heat Exchange" computer program [U.S. Army 1977], available from HEC, which provides output in the form necessary for the HEC-5 program (i.e., ET record images). If HEC-5 computation intervals shorter than daily are going to be used, the use of the "Heat Exchange" program should be substituted with a similar utility program.

The cross-sectional data may be already available in the proper format if previous flood plain or flood damage analysis were studied using the HEC-2 program. Because HEC-2 is a widely used water surface profile program, the author has found the cross-sectional data already available in the proper format on many past water quality studies. For simplification, the HEC-2 type data should be input to the "GEDA" computer program [HEC 1981], available from the HEC, which provides output in the form necessary for the HEC-5Q program (i.e., S3 card images).

The meteorological and cross-sectional data account for about 60% of the water quality portion of the data to be prepared on a typical study.

Tributary inflows, diversions and reservoir discharges may be readily available from WATSTORE and STORET data systems. WATSTORE is managed by the USGS and contains streamflow data. STORET is managed by the EPA and contains water quality data. These computer data systems can often provide the necessary

inflow and reservoir discharge quantity and quality data. Modification of output format to the required HEC-5 input format for the IN, QA, QD and I4 cards is trivial. Past experience has shown that the flow data from WATSTORE is often not available at the same location as water quality data from STORET. Therefore judgement must be used to determine its usability by direct transfer of location or appropriate adjustment. The two types of data must be compatible for the computer program to calculate the appropriate constituent load time series. This type of data is about 20% of the water quality portion of the input data.

The remaining 20% of the typical data set is located by searching through COE reservoir regulation manuals, searching through COE files and making numerous judgement decisions regarding a thorough knowledge of the study objectives, the drainage area being studied and the concepts employed by the HEC-5 model.

Model Execution

The model can be used in several different ways. The cheapest, fastest execution, also requiring the least data preparation, is a steady state analysis. The input, calculation and output intervals are monthly. These may be used for screening monthly data for multiple years to find a critical period (poor water quality condition) for more detailed analysis. This method will only find the most critical period of at least monthly duration and not necessarily critical periods of shorter duration.

The model can be used to study temperature only or temperature and any combination of up to three conservative parameters (i.e., chlorides, total dissolved solids - TDS, alkalinity, specific conductance), up to three nonconservative parameters (i.e., coliform, carbonaceous biochemical oxygen demand - CBOD, ammonia) and dissolved oxygen (DO). If the phytoplankton option is requested, the parameters in the model must include at least temperature, TDS, nitrate, phosphate, phytoplankton, CBOD, ammonia, and DO. The more parameters simulated, the more computation and data preparation time involved. The phytoplankton option is particularly time consuming since all the parameter calculations possible are being performed with this option.

The model can be used for existing and/or proposed reservoirs. If an existing condition is being simulated, usually the objective is to reproduce historical events through model calibration. The calibration option can take about 50% less computer time because the time-consuming linear programming algorithms are not used.

Calibration should begin by reproducing observed temperature profiles in the reservoirs and stream channels. The reservoir diffusion coefficients, A1 and GSWH, provide the best initial adjustments. The second step in reservoir calibration involves adjustments to the three factors affecting light penetration:

secchi disk; solar radiation absorbed near surface, XQPCT; and depth associated with XQPCT amount of solar radiation. The above five variables are interrelated and will need to be adjusted simultaneously. Although many other variables affect the thermal and water quality constituent calibration of reservoirs, it is not recommended to adjust them unless you have more data than normal for reproducing observed profiles. Reservoir calibration decisions may include the user's choice of the input weather station.

The calibration of the river profiles may also involve the users choice of weather stations to index the meteorology affecting the river. Unless more than normal data are available, it is not recommended to adjust any model variables.

Once the model has been calibrated, the objective may be to modify an existing reservoir operation pattern or to evaluate the impact of proposed new reservoirs or channel modifications. This analysis requires the use of the linear programming algorithm and the increase of computer time is significant.

The simulation mode discussed above can be used either to evaluate the best water quality that can be provided throughout the system for given reservoir discharges (obtained either external to the simulation or determined by the HEC-5 quantity part of the model) or to evaluate the best water quality operation without preconceived discharge quantities. The former operation is referred to as a balanced pool operation and the latter as a flow augmentation operation.

The balanced pool operation is the standard HEC-5 analysis for flow. When using the balanced pool operation, the water quality portion of the program simply evaluates the best vertical level for withdrawal at each reservoir (assuming multiple level intakes are available) to meet all downstream water quality targets for the given reservoir discharge.

The flow augmentation operation allows the model to relax the balanced pool concept and to decide how much flow should come from which reservoir and at which vertical level in order to meet downstream water quality targets. Sometimes downstream water quality improvements require significantly increased discharge rates to obtain only small improvements in water quality. This flow augmentation operation is the most-costly execution and not always a practical alternative for real world regulation given power, water conservation and flood control storage considerations.

For this demonstration application, the input data shown in Appendix A was executed using the calibration option. Application of this option allows the user to define the exact level of the intake structure operated and the exact quantity of discharge from each dam. This is the normal method of model application when calibrating the model to observed historical data. This application was executed for water temperature, specific conductance, alkalinity, CBOD, ammonia, and dissolved

oxygen because this was the data available. Actually, all these types of data are very limited in availability on most tributaries but some of them (e.g., temperature, dissolved oxygen and specific conductance) are more readily available as in-channel data. The in-channel data are the optional time dependent data used for calibration.

Selected portions of the computer output are shown in Appendix B. Graphical displays of the results are shown in Appendix C and are discussed in Chapter V.

CHAPTER V

SIMULATION RESULTS

The Sacramento Valley reservoir system operation described in Chapter III was simulated using HEC-5 and produced results which were compared to water quantity and quality data in the four reservoirs and at all downstream control points. The data for comparison purposes consisted of discharge rates at most control points as well as water temperature at many of the same locations. Other water quality parameters are less available but are compared where they are available.

The model simulation for the Sacramento Valley system used temperature, specific conductance (sometimes called electrical conductivity), alkalinity, carbonaceous biochemical oxygen demand (CBOD), ammonia (NH_3) and dissolved oxygen (DO). These specific parameters were chosen based on the availability of at least limited data except for CBOD which was estimated and adjusted by calibration to reproduce DO.

The Sacramento Valley reservoir system results are shown in Appendix B in an abbreviated form. The computer output begins with an echo of the input data. These output should be examined carefully to insure that the program is getting the data that the user expects the program to execute. This step of interpretation of results is important and well worth the required time.

The remainder of the computer output are the day-by-day results of water quality profiles in the reservoirs and along the stream network. The output is quite voluminous and only selected portions have been included. Because it is so voluminous, it is also difficult to interpret in tabular form.

The graphical display of these results is included as Appendix C for the reservoirs and at selected locations along the stream network. While this graphical capability is not a part of HEC-5, an option exists for the model to write the results to an HEC data storage system called DSS [HEC 1985]. An HEC graphics program called DISPLAY (described in the DSS manual) can read the results from DSS and produce plots as shown. These plots satisfactorily demonstrate the capability of HEC-5 to reasonably reproduce observed reservoir and stream profiles on large systems.

The legends at the bottom of the reservoir water quality plots, pages C1-C16, define simulated and observed data for various dates. Shasta, Oroville and Folsom Reservoirs have sufficient observed temperature data to be useful for calibration purposes. Sufficient observed data for the other parameters were not available except in Folsom Reservoir as shown.

Considering the model limitation of having only one weather station for the entire system (subsequently modified to use parameter statements), it is the author's opinion that the reproduction is quite good. Perhaps some further refinement could be achieved with additional trials, but the acceptability of the model can be demonstrated with these results. The Oroville Reservoir observed data anomaly in June (page C6) cannot be explained with the available input, particularly when the much cooler observed hypolimnion temperatures of May and July are noted.

The legend at the bottom of the time series stream plots defines the various observed and simulated water quality parameters for the study period. As with the reservoir plots, only those locations which have sufficient observed data to be used for calibration purposes are shown. Unlike the simulated data, the observed data points are often more than one-day apart. Extreme caution should be applied to any interpolation between observed data points.

In general, the calibration of the model is quite good along the Sacramento River for all the observed parameters downstream to Hamilton City. Butte City and Colusa temperatures (pages C24 and C26 respectively) show that significant warming of this reach of the Sacramento River takes place at least during the Spring (April and May 1979). This temperature consideration, in addition to the lack of sufficient simulated quantity of flow at Butte City and Colusa (pages C23 and C25 respectively) suggests that the undefined return flows on the Sacramento River between Hamilton City to Knights Landing are sufficiently large to cause significant errors. Other parameter reproductions are also poor; apparently due to undefined return flows.

The Feather River below Oroville and the American River below Folsom lack sufficient water quality data to provide adequate information for calibration purposes. The reproduction of observed flow is shown in pages C29 and C30.

Careful interpretation and evaluation of the Sacramento River results lead the author to encourage the continued application of this model to help develop understanding of the workings and operation of any stream system.

CHAPTER VI

SUMMARY

HEC-5 can be used for comprehensive water quality studies involving complex river network and reservoir systems. The program is used to compute the best operation for a reservoir system and determine either the water quality condition resulting from the best water quantity operation (balanced pool method) or the best water quality operation without maintaining balanced reservoir conservation pools for the system (flow alteration method).

The HEC-5 model uses a linear optimization scheme to determine the target water quality at the dam to best meet all user weighted downstream targets. Then a non-linear scheme is used with user weights to determine how the intake structure will be operated.

The Sacramento River results and results of the two additional applications referenced in Chapter II have each provided model improvements and added confidence in the model validation. While it is true that large comprehensive data sets have not been used to validate the model, the author believes that the variety of years modeled and the variety of locations studied have provided sufficient experience to the Corps of Engineers to warrant the continued use and application of the HEC-5 water quality model.

It is the conclusion of this study that HEC-5 is a viable tool for evaluating reservoir systems operation for water quality analysis.

CHAPTER VII

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APPENDIX A

**HEC-5 Input for Sacramento River System
Water Quality Modeling**

T1 HEC-5 INPUT FOR
 T2 SHASTA, OROVILLE AND FOLSOM
 T3 RESERVOIR SYSTEM TEST

J1	0	1	5	3	4	2	0	0
J2	0	1	0	0	0	0	0	0
J3	12	0	0	0	0	1	0	0
J9	0	0	1					
RL	1	4137800	587000	1000000	3252100	4552200	4552200	
RL	1	1	-1	0	587000			
RL	2	1	-1	0	1000000			
RL	3	1	0	0	9999	9999	9999	4370000
					4552200	4552200	4552200	3892000
					4552200	4552200	4552200	9999
RL	4	1	-1	0	4552200			
RL	5	1	-1	0	4552200			
RO	14	2	3	4	5	6	7	8
RO	11	12	19	22	23			9
RS	-18	10	818	1248	3275	3320	3436	3554
RS	3928	3980	4059	4193	4330	4470	4613	4759
RQ	18	0	14000	33700	71500	72000	73600	74900
RQ	79000	79700	85000	100000	130000	170000	220000	267800
RA	18	200	7500	10800	22700	22800	23400	24000
RA	25800	26100	26400	27100	27700	28300	28900	29600
RE	18	630	840	887	1008	1010	1015	1020
RE	1035	1037	1040	1045	1050	1055	1060	1065
R2	7500	2000			240			
R3	99.99	99.99	99.99	.09	6.02	10.41	11.28	8.93
R3	99.99	99.99						8.12
CP	1	79000	1500	1000				-4.49
IDSHASTA		303.8						
RT	1	2						
CP	2	7900	1500	1000				
IDSPRING	CR	300						
RT	2	3						
RL	3	22677	2000	5000	22000	22000	30000	
RO								
RS	18	10	11172	14705	25237	25298	25457	25626
RS	26207	26426	26657	26901	27157	27426	27707	28003
RQ	18	0	15000	30000	110000	111000	120000	130000
RQ160000	170000	180000	190000	200000	210000	220000	230000	248000
RA	18	50	200	250	300	310	325	350
RA	425	450	475	500	525	550	575	610
RE	18	437.5	526.8	542.5	580.8	581.0	581.5	582.0
RE	583.5	584.0	584.5	585.0	585.5	586.0	586.5	587.0
R2	7500	2000			240			
R3	99.99	99.99	99.99	.09	6.02	10.41	11.28	8.93
R3	99.99	99.99						8.12
CP	3	79000	3500	3000				-4.49
IDKESWICK		294.6						
RT	3	4	1.2	.1	24			
CP	4	80000	4000	3500				
IDACID-COW		280.1						
RT	4	5	1.2	.1	24			
DR	4							
CP	5	80000	4000	3500				

IDCOTTONWD	273.2									
RT	5	6								
CP	6	100000	4000	3500						
IDBEND	BR	260.2								
RT	6	7	1.2	.1	24					
CP	7	100000	4000	3500						
IDTC-C	CANAL	243								
RT	7	8	1.2	.1	24					
DR	7				-5					
CP	8	100000	4000	3500						
IDGCID	CANAL	206								
RT	8	9	1.2	.1	24					
DR	8				-5					
CP	9	125000	4000	3500						
IDHAM CITY	199.3									
RT	9	10								
CP	10	130000	4000	3500						
IDBUTTE CY	168.5									
RT	10	11								
CP	11	135000	4000	3500						
IDCOLUSA	143.4									
RT	11	12								
CP	12	140000	4000	3500						
IDGRIMES	117.7									
RT	12	19	1.2	.1	24					
RL	13	3059593	640000	852200	2788000	3538000	3814000			
RL	1	13	-1.0		640000					
RL	2	13	-1.0		852200					
RL	3	13	0	0	9999	9999	9999	3001900	3391900	3537000
RL					3537000	3537000	3537000	3350500	3163000	9999
RL	4	13	-1.0		3538000					
RL	5	13	-1.0		3814000					
RC	8	14	15	16	17	18	19	22	23	
RS	-15	1	10	32	75	148	261	419	629	901
RS	1244	1666	2181	2801	3544	3791				
RQ	15	0	0	0	0	0	0	0	0	4000
RQ	8000	8000	8000	8000	8000	590000				
RA	15	70	300	600	1100	1830	2700	3600	4800	6100
RA	7600	9300	11300	13500	16200	19000				
RE	15	250	300	350	400	450	500	550	600	650
RE	700	750	800	850	900	923				
R2	5000	2500			120					
R3	99.99	99.99	99.99	.35	5.08	8.02	8.56	7.77	7.72	-2.03
R3	99.99	99.99								
CP	13	180000		150	100					
IDOROV DAM	75.4									
RT	13	14								
CP	14	180000		150	100					
IDTD POOL	71.8									
RT	14	15	1.2	.1	24					
DR	14					-5				
CP	15	180000		150	100					
IDFEATHER R	58.8									
RT	15	16								
CP	16	180000		150	100					

IDGRIDLEY 45.6										
RT	16	17	1.2	.1	24					
CP	17	300000	2300	2000						
IDSHANGHI 26.2										
RT	17	18	1.2	.1	24					
CP	18	320000	2300	2000						
IDNICOLAUS 8.1										
RT	18	19	1.2	.1	24					
CP	19	435000	6300	5500						
IDVERONA 80.2										
RT	19	22	1.2	.1	24					
RL	20	832100	1000	90000	610000	1010000	1120000			
RL	1	20	-1.0	0	1000					
RL	2	20	-1.0	0	90000					
RL	3	20	0	0	9999	9999	9999	840000	1009000	1009000
RL					1009000	1009000	1009000	1009000	610000	9999
RL	4	20	-1.0	0	1010000					
RL	5	20	-1.0	0	1120000					
RO	3	21	22	23						
RS	-12	1	8	24	49	89	152	251	398	535
RS	835	1115	1176							
RQ	12	4360	7640	8000	8000	8000	8000	8000	8000	8000
RQ257960	599580	663940								
RA	12	90	510	740	1250	1950	3120	4780	7020	8200
RA	10520	11930	12200							
RE	12	225	250	275	300	325	350	375	400	418
RE	450	475	480							
R2	7500	5000			72					
R3	99.99	99.99	99.99	2.5	8.2	11.2	10.4	9.8	8.1	1.0
R3	99.99	99.99								
CP	20	115000	1300	1000						
IDFOLSOM 28.5										
RT	20	21	1.2	.1	24					
DR	20									
QD	12	9999	9999	9999	62	104	134 ¹	136	129	122
QD	72	9999	9999							
CP	21	115000	1300	1000						
IDFAIR OAKS 21.5										
RT	21	22	1.2	.1	24					
CP	22	435000	7600	6500						
IDI STREET 59.5										
RT	22	23	1.2	.1	24					
CP	23	435000	7600	6500						
IDHOOD 38.3										
RT	23	0								
ED										
BF	0	214		079040100	210	24				
ZW A-HEC5Q F-SIM										
IN	1	1APR79	8520	7810	7910	7920	8740	9170	7510	7130
IN	6740	7460	6500	6930	6580	6950	6930	9080	8170	7200
IN	6750	7170	7570	8150	9290	9180	8450	7270	8130	7680
IN	8320	8840	10210	9580	7980	7920	12230	13210	13690	12460
IN	9940	10560	9670	8360	9010	9370	9490	7650	8300	8050
IN	7190	7460	7770	7530	6260	7740	7060	6370	4400	4450

IN	4930	4740	4970	4590	4370	2660	4750	6490	3680	4030
IN	3970	2280	3420	5600	4870	3940	4070	2950	1490	2710
IN	3890	4450	4500	4870	5820	890	1810	4630	3710	4210
IN	2880	3760	1750	2380	3610	4440	3580	3690	3760	1590
IN	2790	3570	4390	4290	5010	3110	2340	1930	3820	3740
IN	5120	3680	2530	2110	3060	4080	2920	3590	4490	4370
IN	1830	1850	3430	3970	4090	2780	3460	1900	2530	2830
IN	3340	3590	4310	4050	1490	1540	3450	3360	3940	3480
IN	4190	1290	1760	3480	4770	3290	4020	3060	1610	2080
IN	2800	3430	4460	4150	4400	3010	2920	1290	3750	4630
IN	4320	3390	1420	2460	3260	4930	3780	3500	3820	3010
IN	2290	1880	3720	3820	3540	4520	3090	3040	2860	3290
IN	3120	3660	2910	2720	3010	4170	2490	3060	2970	3480
IN	2300	3300	3170	3740	4270	3250	3400	3180	3550	4690
IN	5200	6030	5480	4200	1990	1650	3680	4680	9120	18220
IN	5970	2670	2310	5080	3320	6710				
IN	2	1APR79	718	517	557	595	480	559	495	364
IN	366	315	230	235	0	0	0	279	0	0
IN	370	0	0	215	0	0	0	0	0	492
IN	506	485	632	0	0	0	0	0	215	783
IN	964	433	515	236	0	314	313	352	424	429
IN	742	724	740	873	795	802	736	989	914	796
IN	674	537	604	738	587	582	581	742	601	686
IN	552	877	623	810	665	563	556	593	638	558
IN	617	560	561	585	653	2590	560	805	555	557
IN	579	556	973	2220	2550	2800	2560	2560	2340	2830
IN	2790	2760	2850	2710	2610	2180	1680	2170	2320	2080
IN	2260	2250	2290	2220	2390	2310	2350	1650	1630	1740
IN	1650	1620	1580	1690	2470	2460	2620	2610	2590	2350
IN	2590	2600	2610	2660	2580	2240	2630	2560	2600	2740
IN	2740	2790	2840	2790	2970	2880	2790	2830	2570	2530
IN	2520	2450	2620	2620	2580	2710	2700	2680	2700	1460
IN	1560	1480	1570	1570	1670	1640	1630	1540	1330	1550
IN	1550	1540	1650	1490	1500	1580	1490	1570	1480	1480
IN	1480	1500	1530	1500	1300	418	433	430	432	430
IN	505	428	374	376	419	416	417	484	460	456
IN	623	1610	1640	1660	2360	2280	2300	2280	2290	2480
IN	2530	2280	2200	2290	2290	2290				
IN	4	1APR79	609	551	509	478	467	491	509	462
IN	461	451	432	418	416	439	438	502	800	679
IN	510	462	437	443	585	1610	868	712	1000	745
IN	655	610	1070	889	733	695	1540	1530	1510	1200
IN	991	821	719	657	618	611	586	577	539	505
IN	496	478	465	456	437	392	367	349	317	296
IN	269	246	223	205	194	188	182	154	142	126
IN	114	113	107	101	87	76	71	72	76	80
IN	83	84	78	78	73	69	63	60	57	54
IN	47	42	37	38	37	37	44	47	47	48
IN	46	40	34	36	35	32	27	27	19	20
IN	21	22	23	19	19	18	20	20	18	19
IN	23	18	17	13	12	10	11	11	12	8
IN	9.1	12	10	9.7	11	12	11	11	18	14
IN	13	13	16	20	23	21	25	22	17	19
IN	10	17	54	95	111	73	68	63	55	52
IN	48	32	27	26	25	23	17	16	15	12

**Most of the Time Series Inflow (IN), Specified Discharge (QA),
Natural Flow (NQ), and Division (QD) Records
have been deleted from this listing.**

QD	14	1APR79	499	498	479	467	467	468	467	467
QD	580	772	919	992	1095	1244	1281	1564	1750	1781
QD	1917	2079	2265	2463	2484	2394	2377	2287	2212	2189
QD	2189	2204	2186	2237	2408	2690	2962	3072	3223	3423
QD	3434	3550	3661	3658	3665	3704	3658	3594	3519	3472
QD	3379	3321	3230	3131	3086	3019	2929	2876	2864	2828
QD	2821	2844	2840	2860	2895	2928	3008	3082	3124	3125
QD	3158	3192	3210	3292	3280	3291	3312	3310	3357	3356
QD	3359	3360	3359	3361	3355	3369	3366	3377	3396	3403
QD	3414	3399	3367	3345	3339	3283	3224	3220	3203	3198
QD	3224	3222	3220	3208	3221	3245	3262	3271	3304	3318
QD	3352	3357	3375	3346	3320	3291	3289	3277	3301	3289
QD	3272	3256	3245	3248	3226	3215	3211	3198	3203	3189
QD	3171	3178	3159	3124	3122	3132	3097	3055	3054	3077
QD	3053	2988	2972	2968	2967	2929	2884	2830	2780	2767
QD	2745	2712	2681	2610	2498	2391	2384	2352	2257	2193
QD	2113	2010	1940	1895	1827	1713	1580	1518	1499	1445
QD	1423	1345	1273	1206	1179	1161	1146	1140	1123	1035
QD	966	967	972	954	957	962	954	974	1028	1070
QD	1065	1066	1043	1024	1023	1019	1020	1024	1019	1024
QD	1017	1017	1016	1021	1021	1022	1014	1001	999	870
QD	799	694	515	517	516	610				

NOLIST

EJ

TI WATER QUALITY DATA FOR
 TI SHASTA, OROVILLE AND FOLSOM
 TI RESERVOIR SYSTEM TEST
 JA 790401 791027 23 4 C 0
 EZ -1
 ET 91 58.3 121.6 2032.2 11.0
 ET 92 60.5 118.1 2083.4 10.0
 ET 93 62.9 91.8 1618.1 7.0
 ET 94 72.9 67.5 2081.8 4.0
 ET 95 64.4 118.5 2060.8 9.0
 ET 96 58.1 79.0 1016.9 6.0
 ET 97 65.3 107.1 2142.5 8.0
 ET 98 58.5 141.7 1486.5 12.0
 ET 99 58.8 111.6 1858.7 10.0
 ET 100 56.0 125.3 2007.7 12.0
 ET 101 65.3 94.9 1856.2 7.0
 ET 102 63.4 116.0 1864.8 9.0
 ET 103 67.8 98.3 2229.5 7.0
 ET 104 68.5 99.2 2196.4 7.0
 ET 105 65.6 96.8 1551.0 7.0
 ET 106 57.4 140.2 1339.5 12.0
 ET 107 60.2 88.5 1580.8 7.0
 ET 108 64.1 78.2 2203.9 6.0
 ET 109 67.2 68.4 2302.6 5.0
 ET 110 58.7 74.8 1121.7 6.0
 ET 111 65.3 80.3 1824.4 6.0
 ET 112 59.3 121.8 1383.7 10.0
 ET 113 60.6 123.5 1824.4 10.0
 ET 114 65.0 81.3 1847.1 6.0
 ET 115 68.4 62.9 1407.7 4.0
 ET 116 62.2 87.5 829.5 6.0
 ET 117 71.3 79.6 2014.9 5.0
 ET 118 68.4 87.9 2032.7 6.0
 ET 119 63.7 84.3 1153.3 6.0
 ET 120 63.2 128.1 1882.5 10.0
 ET 121 65.6 85.3 1682.0 6.0
 ET 122 72.4 105.7 2449.9 7.0
 ET 123 64.9 153.6 2335.7 12.0
 ET 124 59.5 131.5 1184.1 11.0
 ET 125 59.6 151.3 1718.9 13.0
 ET 126 59.0 118.3 1481.1 10.0
 ET 127 56.6 124.4 1489.1 11.0
 ET 128 63.2 106.7 2558.3 9.0
 ET 129 63.1 126.9 2566.9 11.0
 ET 130 70.8 94.0 2575.5 7.0
 ET 131 76.4 76.3 2583.8 5.0
 ET 132 87.7 68.0 2506.3 3.0
 ET 133 89.0 69.1 2516.4 3.0
 ET 134 82.2 96.2 2519.5 5.0
 ET 135 67.5 180.6 2540.8 13.0
 ET 136 77.5 88.0 2415.0 5.0
 ET 137 80.9 92.8 2557.5 5.0
 ET 138 77.5 132.7 2565.2 8.0
 ET 139 73.3 156.2 2560.2 10.0

**Most of the Weather Records (ET) have been
deleted from this listing.**

ET	273	74.0	83.6	1659.7	5.0
ET	274	72.4	109.7	1639.5	7.0
ET	275	69.4	134.1	1614.9	9.0
ET	276	76.5	44.5	770.3	2.0
ET	277	68.9	118.0	1586.8	8.0
ET	278	70.4	94.0	1539.6	6.0
ET	279	65.2	100.9	749.5	7.0
ET	280	64.5	135.0	1511.2	10.0
ET	281	63.7	76.0	900.4	5.0
ET	282	75.4	59.7	1494.0	3.0
ET	283	71.1	81.6	1343.6	5.0
ET	284	66.7	115.0	1329.5	8.0
ET	285	64.7	76.1	866.6	5.0
ET	286	66.6	107.5	689.2	7.0
ET	287	66.4	108.4	680.2	7.0
ET	288	69.0	97.0	966.7	6.0
ET	289	68.4	105.5	1393.1	7.0
ET	290	66.9	75.9	1254.9	5.0
ET	291	57.3	121.5	495.5	10.0
ET	292	59.2	165.7	483.0	13.0
ET	293	57.2	101.1	1051.9	8.0
ET	294	60.0	58.1	1271.8	4.0
ET	295	58.9	79.1	921.8	6.0
ET	296	60.4	108.3	628.1	8.0
ET	297	59.0	104.8	624.7	8.0
ET	298	58.5	116.4	616.5	9.0
ET	299	61.8	72.1	1231.0	5.0
ET	300	67.2	39.4	1257.3	2.0
ET	301	58.1	96.1	1256.1	8.0
ET	302	51.7	156.4	1257.0	16.0
ET	303	51.1	70.0	732.9	6.0
ET	-304	58.5	66.7	1199.3	5.0

QC		1	1	0	0	1	1	1
TQ	SPECIFIC CONDUCTANCE							
TQ	TOTAL ALKALINITY							
TQ	CARBONACEOUS BOD							
TQ	AMMONIA AS N							
TQ	DISSOLVED OXYGEN							
L1		30	1					
L2	1	10	0	5	.6	1.5		1
LR	1	100000						
L3	.01	1.0-6	.3-4	0	-.7			
L6	330	186000	1037					
L7	18	14000	815					
L8	0	50	850	1800	3350	3400	3500	3600
L8		3900	3950	4000	4500	4600	4700	4800
PL	10	100	0	-2				
PL	5	100	0	-.1				
PL	3	100	0	-.1				
PL	1	100	0	-2				
PL	3	100	0	-10				
PL	5	100	3.2	-.7	.1	-.005		
L9	0	5.7	5.7	6.2	8.5	8.7	8.9	9.1
L9		9.5	9.6	9.7	9.7	9.8	9.8	9.8
C1		130	130	130	130	130	130	130
C1		130	130	130	130	130	130	130
C2		45	45	45	45	45	45	45
C2		45	45	45	45	45	45	45
C5	.1	.1	.1	.1	.1	.1	.1	.1
C5	.1	.1	.1	.1	.1	.1	.1	.1
C6	.002	.002	.002	.002	.002	.002	.002	.002
C6	.002	.002	.002	.002	.002	.002	.002	.002
C7	5	5	5	5	5	5	5	5
C7	5	5	5	5	5	5	5	5
SA	100	100	100	100	100	100	100	100
SA	100	100	100	100	100	100	100	100
DK	0	.1	.05	1.463	4.57			
L2	3	10	47500	3	.6	1	1	
LR								
L3	.01	1.0-6	.3-4	0	-.7			
L6	200	248000	560					
L7	1173	15000	514					
L8	0	40	450	500	600	610	640	670
L8		760	790	820	850	880	910	940
PL	10	100	0	-2				
PL	5	100	0	-.1				
PL	3	100	0	-.1				
PL	1	100	0	-2				
PL	3	100	0	-10				
PL	5	100	3.2	-.7	.1	-.005		
L9	9	9	9	9	9	9	9	9
L9	9	9	9	9	9	9	9	9
C1	130	130	130	130	130	130	130	130
C1	130	130	130	130	130	130	130	130
C2	45	45	45	45	45	45	45	45
C2	45	45	45	45	45	45	45	45
C5	.1	.1	.1	.1	.1	.1	.1	.1
C5	.1	.1	.1	.1	.1	.1	.1	.1

C6	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
C6	.002	.002	.002	.002	.002	.002	.002	.002	.002	.002
C7	5	5	5	5	5	5	5	5	5	5
C7	5	5	5	5	5	5	5	5	5	5
SA	100	100	100	100	100	100	100	100	100	100
SA	100	100	100	100	100	100	100	100	100	100
DK	0	.1	.05	1.463	4.57					
L2	13	14	0	10	.4	1				
LR	2	30000								
L3	.01	1.0-6	.3-4		0	-.7				
L6	180	350000	901							
L7	10	4000	652	720	788	856				
L7	10	4000	669	737	805	873				
L8		200	400	600	800	1000	1200	1400	1600	1800
L8		2000	2300	2600	3000	3300	3500			
PL	10	100	0	-.2						
PL	5	100	0	-.1						
PL	3	100	0	-.1						
PL	1	100	0	-.2						
PL	3	100	0	-10						
PL	5	100	3.2	-.7	.1	-.005				
L9	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67
L9	7.78	9.44	12.8	10.0	12.8	12.8				
C1	62	62	62	62	62	62	62	62	62	62
C1	62	62	62	62	62	62				
C2	40	40	40	40	40	40	40	40	40	40
C2	40	40	40	40	40	40				
C5	0	0	0	0	0	0	0	0	0	0
C5	0	0	0	0	0	0				
C6	0	0	0	0	0	0	0	0	0	0
C6	0	0	0	0	0	0				
C7	.5	1	1.5	2	2.5	3	3.5	4	5	
C7	6	7	8	9	10	10				
SA	100	100	100	100	100	100	100	100	100	100
SA	100	100	100	100	100	100				
DK	0	.1	.05	1.463	4.57					
L2	20	7	0	12	.4	2				
LR	3	26400								
L3	.01	1.0-6	1.-4		0	-.7				
L6	336	567000	418							
L7	10.4	8000	307							
L8		100	500	1000	2000	3000	4000	5000	6000	7000
L8		8000	9000	10000	11000					
PL	10	100	0	-.2						
PL	5	100	0	-.1						
PL	3	100	0	-.1						
PL	1	100	0	-.2						
PL	3	100	0	-10						
PL	5	100	3.2	-.7	.1	-.005				
L9	8	8	8.5	8.5	9	9.3	10	12.7	13.3	
L9	13.3	13.3	13.3	13.3						
C1	70	70	70	70	70	70	70	70	70	70
C1	70	70	70	70						
C2	20	20	20	20	20	20	20	20	20	20
C2	20	20	20	20						

C5	0	0	0	0	0	0	0	0	0	0
C5	0	0	0	0						
C6	.02	.02	.02	.02	.02	.02	.02	.02	.02	.02
C6	.02	.02	.02	.02						
C7	10.5	10.5	10.7	10.7	10.7	10.6	11.1	11.4	11.3	
C7	11.3	11.3	11.3	11.3						
SA	100	100	100	100	100	100	100	100	100	100
SA	100	100	100	100						
DK	0	.1	.05	1.463	4.57					
CR	1.047	1.047	1.047	1.0159						
S1	30	1	0	95	21					
S2	1	303.80	2	300.00	1.90	300.0	4			
S2					1					
S2	3	294.58	4	275.94	4.66	280.1	5			
S2	4	275.94	5	271.28	2.33	273.2	6			
S2	5	271.28	6	261.96	4.66	271.2	7			
S2	6	261.96	7	243.32	4.66					
S2	7	243.32	8	206.04	4.66	225.1	8			
S2	8	206.04	9	196.72	4.66					
S2	9	196.72	10	168.76	4.66					
S2	10	168.76	11	140.80	4.66					
S2	11	140.80	12	117.50	4.66					
S2	12	117.50	19	80.22	4.66					
S2	13	75.38	14	71.82	1.78	75.00	9			
S2	14	71.82	15	58.84	3.245	58.84	9			
S2	15	58.84	16	45.56	3.32					
S2	16	45.56	17	26.25	2.41375	29.65	10			
S2	17	26.25	18	8.76	4.3725	12.30	11			
S2	18	8.76	19	0.0	4.38					
S2	19	80.22	22	59.64	4.116					
S2	20	28.53	21	20.93	2.533					
S2	21	20.93	22	0.0	4.186					
S2	22	59.64	23	38.28	2.67					
SR	-1	23	1	2						
S3	1	303.800	478.00	0.	0.00	0.	0.0518			
S3	1	303.800	479.00	116.	0.92	121.	0.0518			
S3	1	303.800	480.00	243.	1.43	133.	0.0518			
S3	1	303.800	481.00	382.	1.86	145.	0.0518			
S3	1	303.800	482.00	534.	2.24	154.	0.0518			
S3	1	303.800	483.00	693.	2.58	165.	0.0518			
S3	1	303.800	484.00	864.	2.88	176.	0.0518			
S3	1	303.800	485.00	1042.	3.18	182.	0.0518			
S3	1	303.800	486.00	1227.	3.46	187.	0.0518			
S3	1	303.800	487.00	1416.	3.72	191.	0.0518			
S3	1	303.800	489.00	1807.	4.21	200.	0.0518			
S3	1	303.800	491.00	2215.	4.65	208.	0.0518			
S3	1	303.800	493.00	2642.	5.05	219.	0.0516			
S3	1	303.800	495.00	3095.	5.38	234.	0.0512			
S3	1	303.800	497.00	3584.	5.64	256.	0.0503			
S3	1	303.800	499.00	4116.	5.91	277.	0.0497			
S3	1	303.800	501.00	4699.	5.99	310.	0.0478			
S3	1	303.800	503.00	5366.	5.83	361.	0.0447			
S3	1	303.800	506.00	6585.	5.84	444.	0.0431			
S3	1	303.800	509.00	8019.	6.02	517.	0.0430			
S3	1	303.800	512.00	9695.	6.25	593.	0.0432			

Most of the Cross Section Geometry (S3) records
have been deleted from this listing.

S3	23	38.280	-27.20	0.	0.00	0.	0.0350		
S3	23	38.280	-26.20	37.	0.70	62.	0.0350		
S3	23	38.280	-25.20	107.	1.21	78.	0.0350		
S3	23	38.280	-24.20	197.	1.46	108.	0.0350		
S3	23	38.280	-23.20	329.	1.67	151.	0.0350		
S3	23	38.280	-22.20	500.	1.93	187.	0.0350		
S3	23	38.280	-21.20	699.	2.24	210.	0.0350		
S3	23	38.280	-20.20	921.	2.49	236.	0.0350		
S3	23	38.280	-19.20	1173.	2.68	276.	0.0350		
S3	23	38.280	-18.20	1457.	2.95	293.	0.0350		
S3	23	38.280	-16.20	2100.	3.29	352.	0.0350		
S3	23	38.280	-14.20	2818.	3.89	365.	0.0350		
S3	23	38.280	-12.20	3559.	4.43	377.	0.0350		
S3	23	38.280	-10.20	4323.	4.95	386.	0.0350		
S3	23	38.280	-8.20	5110.	5.40	399.	0.0350		
S3	23	38.280	-6.20	5919.	5.84	410.	0.0350		
S3	23	38.280	-4.20	6749.	6.26	420.	0.0350		
S3	23	38.280	-2.20	7601.	6.66	431.	0.0350		
S3	23	38.280	0.80	8919.	7.22	447.	0.0350		
S3	23	38.280	3.80	10285.	7.75	463.	0.0350		
S3	23	38.280	6.80	11695.	8.26	477.	0.0350		
S4	488.00	484.00	474.00	470.82	448.33	412.26	380.34	361.08	349.15
S4	326.12	304.00	288.02	265.60	252.15	245.73	234.40	212.83	196.14
S4	186.62	173.24	154.59	149.59	144.68	131.72	114.81	107.99	100.84
S4	90.88	82.48	75.01	64.09	57.11	49.00	41.94	39.89	35.20
S4	32.80	30.70	26.86	22.49	20.97	20.92	18.02	13.21	10.86
S4	6.00	5.00	4.00	3.00	225	207	207	150	126.4
S4	105	94	80	72	61	60	57	54	48
S4	45	44	37	36	35	34	33	27	19
S4	11	4	3.0	1.5	1.0	0.5	117	109	96
S4	85	65	42	30	20	10	0	-1	-2
S4	-3	-4	-5	-6	-7				

KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
KR	.1	.1	.05	1.463	4.57
CT	1 790401	12	1	0	
CT	-791031	12	1	0	
CT	790401	130	1	0	
CT	-791031	130	1	0	
CT	790401	60	1	0	
CT	-791031	60	1	0	
CT	790401	5	1	0	
CT	-791031	5	1	0	
CT	790401	.1	1	0	
CT	-791031	.1	1	0	
CT	790401	5	0	1	
CT	-791031	5	0	1	
CT	2 790401	12	1	0	
CT	-791031	12	1	0	
CT	790401	130	1	0	
CT	-791031	130	1	0	
CT	790401	60	1	0	
CT	-791031	60	1	0	
CT	790401	5	1	0	
CT	-791031	5	1	0	
CT	790401	.1	1	0	
CT	-791031	.1	1	0	
CT	790401	5	0	1	
CT	-791031	5	0	1	
CT	3 790401	12	1	0	
CT	-791031	12	1	0	
CT	790401	130	1	0	
CT	-791031	130	1	0	
CT	790401	60	1	0	
CT	-791031	60	1	0	
CT	790401	5	1	0	
CT	-791031	5	1	0	
CT	790401	.1	1	0	
CT	-791031	.1	1	0	

Most of the Control Point Target records (CT)
have been deleted from this listing.

CT	23	790401	14	1	0				
CT		790516	19	1	0				
CT		790614	21.5	1	0				
CT		790726	22.5	1	0				
CT		790823	21.0	1	0				
CT		790913	21.5	1	0				
CT		-791031	19.0	1	0				
CT		790401	150	1	0				
CT		790515	130	1	0				
CT		790612	148	1	0				
CT		790726	130	1	0				
CT		790823	157	1	0				
CT		790913	189	1	0				
CT		-791031	190	1	0				
CT		790401	64	1	0				
CT		790515	43	1	0				
CT		790612	51	1	0				
CT		790726	48	1	0				
CT		790823	69	1	0				
CT		790913	72	1	0				
CT		-791031	72	1	0				
CT		790401	20	1	0				
CT		-791031	20	1	0				
CT		790401	5	1	0				
CT		-791031	5	1	0				
CT		790401	10	0	1				
CT		790726	7.8	0	1				
CT		-791031	7.8	0	1				
I1		790401	791031						
I2			0	INFLOW - TOTAL LOCAL FLOW					
I4		790401	-1	491031	-1	-1			
I2		1	0	SHASTA INFLOW					
I4		790401	-15	490707	-12	791031	-5	-1	
I2			0	SHASTA INFLOW EC					
I4		790401	120	790529	120	790716	140	791011	120
I4		791031	120	-1					
I2			0	SHASTA INFLOW ALKALINITY					
I4		790401	55	790502	55	790529	45	790716	50
I4		790911	64	791031	64	-1			
I2			0	SHASTA INFLOW BOD					
I4		790401	1.5	791031	.8	-1			
I2			0	SHASTA INFLOW NH3					
I4		790401	0	790716	.02	790919	.03	791031	0
I4			-1						
I2			-1	0	SHASTA INFLOW DO				
I4		790401	100	791031	100	-1			
I2			0	INFLOW - TOTAL LOCAL FLOW					
I4		790401	-1	491031	-1	-1			

I2		0	OROVILLE INFLOW					
I4	790401	12.8	790701	14.0	790718	18.3	790801	12.0
I4	790901	10.0	791001	7.22	791031	4.44	-1	
I2		0	OROVILLE INFLOW EC					
I4	790401	62	790718	60	791031	60	-1	
I2		0	OROVILLE INFLOW ALKALINITY					
I4	790401	150	791031	150	-1			
I2		0	OROVILLE INFLOW BOD					
I4	790401	5	791031	5	-1			
I2		0	OROVILLE INFLOW AMMONIA					
I4	790401	.01	790718	0	791031	0	-1	
I2		0	OROVILLE INFLOW DISOLVED OXYGEN					
I4	790401	10.4	790718	8.5	791031	8.5	-1	
I2		0	INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1	491031	-1	-1			
I2		0	FOLSOM INFLOW					
I4	790401	8.0	790530	14.0	790727	14.0	791022	15.0
I4	-1							
I2		0	FOLSOM INFLOW EC					
I4	790401	74	790516	71	790614	76	790718	74
I4	790807	67	790911	62	791031	61	-1	
I2		0	FOLSOM INFLOW ALKALINITY					
I4	790401	20	790530	13	790727	19	791031	19
I4	-1							
I2		0	FOLSOM INFLOW BOD					
I4	790401	5	791031	5	-1			
I2		0	FOLSOM INFLOW AMMONIA					
I4	790401	.01	790530	.09	790718	.02	790727	0
I4	790807	.01	791031	.01	-1			
I2		0	FOLSOM INFLOW DO					
I4	790401	10.7	790516	9.4	790530	10.6	790614	9.1
I4	790718	9.5	790727	10	790807	7.9	790911	8.6
I4	791031	10.6	-1					
I2		0	INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1	491031	-1	-1			
I2	1	0	SPRING CR. INFLOW					
I4	790401	-5	790707	-2	791031	-7	-1	
I2		0	SPRING CR. EC					
I4	790401	200	791031	200	-1			
I2		0	SPRING CR. ALKALINITY					
I4	790401	55	791031	55	-1			
I2		0	SPRING CR. BOD					
I4	790401	0	791031	0	-1			
I2		0	SPRING CR. NH3					
I4	790401	.00	791031	.00	-1			
I2	-1	0	SPRING CR. DO					
I4	790401	125	791031	125	-1			
I2		0	INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1	491031	-1	-1			
I2	1	0	COW CR. INFLOW					
I4	790401	0	790707	-2	791031	-7	-1	
I2		0	COW CR. EC					
I4	790401	200	791031	200	-1			
I2		0	COW CR. ALKALINITY					
I4	790401	100	791031	100	-1			

I2		0 COW CR. BOD					
I4	790401	0 791031	0	-1			
I2		0 COW CR. NH3					
I4	790401	.00 791031	.00	-1			
I2		0 COW CR. DO					
I4	790401	135 791031	135	-1			
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1	-1			
I2		0 COTTONWOOD CR. INFLOW					
I4	790401	0 790707	-2 791031	-7	-1		
I2		0 COTTONWOOD CR. EC					
I4	790401	200 791031	200	-1			
I2		0 COTTONWOOD CR. ALKALINITY					
I4	790401	100 791031	100	-1			
I2		0 COTTONWOOD CR. BOD					
I4	790401	0 791031	0	-1			
I2		0 COTTONWOOD CR. NH3					
I4	790401	.00 791031	.00	-1			
I2		0 COTTONWOOD CR. DO					
I4	790401	135 791031	135	-1			
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1	-1			
I2		0 BATTLE CR. INFLOW					
I4	790401	0 790707	-2 791031	-7	-1		
I2		0 BATTLE CR. EC					
I4	790401	200 791031	200	-1			
I2		0 BATTLE CR. ALKALINITY					
I4	790401	100 791031	100	-1			
I2		0 BATTLE CR. BOD					
I4	790401	0 791031	0	-1			
I2		0 BATTLE CR. NH3					
I4	790401	.00 791031	.00	-1			
I2		0 BATTLE CR. DO					
I4	790401	135 791031	135	-1			
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1	-1			
I2		0 THOMES CR. INFLOW					
I4	790401	5 790625	9 791031	5	-1		
I2		0 THOMES CR. EC					
I4	790401	350 791031	350	-1			
I2		0 THOMES CR. ALKALINITY					
I4	790401	350 791031	350	-1			
I2		0 THOMES CR. BOD					
I4	790401	10 790601	20 791001	20	791031	10	
I4		-1					
I2		0 THOMES CR. NH3					
I4	790401	.05 791031	.05	-1			
I2		0 THOMES CR. DO					
I4	790401	135 791031	135	-1			
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1	-1			
I2		0 BYPASSED FEATHER RIVER					
I4	790401	13.9 790418	14.4 790516	17.8 790718	15.6		
I4	790815	15.6 790919	12.2 791031	12.2	-1		

I2		0 BYPASSED FEATHER RIVER EC					
I4	790401	68 790418	68 790516	64	790718	65	
I4	790815	65 791031	51 -1				
I2		0 BYPASSED FEATHER RIVER ALKALINITY					
I4	790401	40 791031	50 -1				
I2		0 BYPASSED FEATHER RIVER BOD					
I4	790401	.5 791031	.5 -1				
I2		0 BYPASSED FEATHER RIVER AMMONIA					
I4	790401	.03 790516	.01 790718	0	791031	0	
I4	-1						
I2		0 BYPASSED FEATHER RIVER DISSOLVED OXYGEN					
I4	790401	10 790418	10 790516	9.2	790718	8.6	
I4	790815	7.6 790919	6.2 791031	6.2	-1		
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1 -1				
I2		0 YUBA RIVER					
I4	790401	11.0 790424	13.5 790524	15.5	790621	18.0	
I4	790726	16.5 790823	11.5 790920	15.5	791031	15.5	
I4	-1						
I2		0 YUBA RIVER EC					
I4	790401	87 790424	92 790523	72	790621	78	
I4	790726	74 790823	76 790920	76	791031	76	
I4	-1						
I2		0 YUBA RIVER ALKALINITY					
I4	790401	34 790424	36 790523	29	790621	31	
I4	790726	31 790823	31 790920	32	791031	32	
I4	-1						
I2		0 YUBA RIVER BOD					
I4	790401	10. 791031	10. -1				
I2		0 YUBA RIVER AMMONIA					
I4	790401	.01 790424	.00 790523	.02	790621	.00	
I4	790726	.00 790823	.02 790921	.00	791031	.00	
I4	-1						
I2		0 YUBA RIVER DO					
I4	790401	11.0 790424	10.8 790523	10.0	790621	9.5	
I4	790726	9.9 790823	9.9 790920	10.3	791031	10.3	
I4	-1						
I2		0 INFLOW - TOTAL LOCAL FLOW					
I4	790401	-1 491031	-1 -1				
I2		0 BEAR RIVER					
I4	790401	13.5 790424	14.5 790523	21.0	790621	24.0	
I4	790726	25.5 790823	25.5 790920	19.0	791031	19.0	
I4	-1						
I2		0 BEAR RIVER EC					
I4	790401	91 790424	89 790523	82	790621	210	
I4	790726	174 790823	199 790920	190	791031	190	
I4	-1						
I2		0 BEAR RIVER ALKALINITY					
I4	790401	30 790424	28 790523	26	790621	67	
I4	790726	63 790823	75 790920	74	791031	74	
I4	-1						
I2		0 BEAR RIVER BOD					
I4	790401	10. 791031	10. -1				
I2		0 BEAR RIVER AMMONIA					
I4	790401	.35 791031	.35 -1				

		0 BEAR RIVER DO							
I2		790401	11.0	790424	9.7	790523	8.3	790621	8.8
I4		790823	9.9	790920	8.4	791031	8.4	-1	
G1	790401	791031							
G2	1	790401	791031	0	0	1	1		
G2	3	790401	791031	0	0	1	1		
G2	13	790401	791031	0	0	1	4	1	4
G2	20	790401	-791031	0	0	1	1		
ER									

APPENDIX B

**Selected Computer Output for Sacramento River System
Water Quality Modeling**

WATER QUALITY DATA FOR
SHASTA, CROVILLE AND FOLSOM
RESERVOIR SYSTEM TEST

DAY OF SIMULATION	FIRST DAY OF SIMULATION	210
FINAL DAY OF SIMULATION	91 (79/ 4/ 1)	
NUMBER OF CONTROL POINTS	300 (79/10/27)	
NUMBER OF RESERVOIRS	23	
INPUT UNITS (ENGLISH=0/METRIC=1)	4	
	0	
	C	
WATER TEMPERATURE UNITS		
SCRATCH FILE NUMBER 1	62	
SCRATCH FILE NUMBER 3	21	
SCRATCH FILE NUMBER 4	64	
SCRATCH FILE NUMBER 5	65	
SCRATCH FILE NUMBER 6	66	
SCRATCH FILE NUMBER 7	67	

METEOROLOGICAL DATA SUMMARY						
DATE	ZONE	EQT.TEMP	HEAT.EXTC	SHORT.IW	WIND.SPD	ZONE
91/24	1	58.30	121.60	2032.20	11.00	
92/24	1	60.50	118.10	2083.40	10.00	
93/24	1	62.90	91.80	1618.10	7.00	
94/24	1	72.90	67.50	2081.80	4.00	
95/24	1	64.40	118.50	2060.80	9.00	
96/24	1	58.10	79.00	1016.90	6.00	
97/24	1	65.30	107.10	2142.50	8.00	
98/24	1	58.50	141.70	1486.50	12.00	
99/24	1	58.80	111.60	1858.70	10.00	
100/24	1	56.00	125.30	2007.70	12.00	
101/24	1	65.30	94.90	1856.20	7.00	
102/24	1	63.40	116.00	1864.80	9.00	
103/24	1	67.80	98.30	2229.50	7.00	
104/24	1	68.50	99.20	2196.40	7.00	
105/24	1	65.60	96.80	1551.00	7.00	
106/24	1	57.40	140.20	1339.50	12.00	
107/24	1	60.20	88.50	1580.80	7.00	
108/24	1	64.10	78.20	2203.90	6.00	
109/24	1	67.20	68.40	2302.60	5.00	
110/24	1	58.70	74.80	1121.70	6.00	
111/24	1	65.30	80.30	1824.40	6.00	
112/24	1	59.30	121.80	1383.70	10.00	
113/24	1	60.60	123.50	1824.40	10.00	
114/24	1	65.00	81.30	1847.10	6.00	
115/24	1	68.40	62.90	1407.70	4.00	
116/24	1	62.20	87.50	829.50	6.00	
117/24	1	71.30	79.60	2014.90	5.00	
118/24	1	68.40	87.90	2032.70	6.00	
119/24	1	63.70	84.30	1153.30	6.00	
120/24	1	63.20	128.10	1882.50	10.00	
121/24	1	65.60	85.30	1682.00	6.00	
122/24	1	72.40	105.70	2449.90	7.00	
123/24	1	64.90	153.60	2335.70	12.00	
124/24	1	59.50	131.50	1184.10	11.00	

285/24	1	66.70	76.10	866.40	5.00
286/24	1	66.60	107.50	689.20	7.00
287/24	1	66.40	108.40	680.20	7.00
288/24	1	69.00	97.00	966.70	6.00
289/24	1	68.40	105.50	1393.10	7.00
290/24	1	66.90	75.90	1254.90	5.00
291/24	1	57.30	121.50	495.50	10.00
292/24	1	59.20	165.70	483.80	15.00
293/24	1	57.20	101.10	1051.90	8.00
294/24	1	60.00	58.10	1271.80	4.00
295/24	1	58.90	79.10	921.80	6.00
296/24	1	60.40	108.30	628.10	8.00
297/24	1	59.00	104.80	624.70	8.00
298/24	1	58.50	116.40	616.50	9.00
299/24	1	61.80	72.10	1231.00	5.00
300/24	1	67.20	39.40	1257.30	2.00
301/24	1	58.10	96.10	1256.10	8.00
302/24	1	51.70	156.40	1257.00	16.00
303/24	1	51.10	70.00	732.90	6.00
304/24	1	58.50	66.70	1199.30	5.00

IN ADDITION TO TEMPERATURE, THE FOLLOWING CONSTITUENTS ARE BEING SIMULATED. (EXCEPT AS NOTED)

SPECIFIC CONDUCTANCE
 TOTAL ALKALINITY
 CARBONACEOUS BOD
 AMMONIA AS N
 DISSOLVED OXYGEN

INDICATES QUALITY DATA WILL BE READ BUT NOT SIMULATED

RESERVOIR RELATED DATA

PRINTOUT INTERVAL, DAYS
VERTICAL LAYER PRINTOUT INTERVAL

30
1

RESERVOIR NUMBER	1
CONTROL POINT I.D.	1
LAYER THICKNESS, FT	10.0
MAXIMUM WATER SURFACE ELEVATION, FT	1070.0
BOTTOM ELEVATION, FT	630.0
STARTING RESERVOIR VOLUME, ACFT	4137800.
SECCI DISK DEPTH, FT	5.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.50
FRACTION OF SOLAR ENERGY ABSORBED	0.60
METEOROLOGICAL DATA ZONE	1
INFLOW I.D.	EFFECTIVE RES. LENGTH, FT
1	100000.
WATER COLUMN MINIMUM STABILITY, KG/M3/N	0.10E-01
WATER COLUMN CRITICAL STABILITY (GSMH), KG/M3/N	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.30E-06
Coefficient relating gradient to dispersion (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	330.00	186000.00	41	1037.00
WEIR WELL 1	18.00	14000.00	19	815.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS
1	1.00E+01	1.00E-02 0.00E+00 -2.00E+00
2	5.00E+00	1.00E-02 0.00E+00 -1.00E-01
3	3.00E+00	1.00E-02 0.00E+00 -1.00E-01
6	1.00E+00	1.00E-02 0.00E+00 -2.00E+00
7	3.00E+00	1.00E-02 0.00E+00 -1.00E-01
8	5.00E+00	1.00E-02 3.20E+00 -7.00E-01 1.00E-01 -5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	630.0	200.	0.	13737.	50.	5.70
2	640.0	547.	13737.	7211.	88.	5.70
3	650.0	895.	20948.	10685.	126.	5.70
4	660.0	1242.	31633.	14159.	164.	5.70
5	670.0	1590.	45791.	17333.	202.	5.70
6	680.0	1937.	63426.	21107.	240.	5.70
7	690.0	2284.	84531.	24580.	279.	5.70
8	700.0	2632.	109111.	28054.	317.	5.70
9	710.0	2979.	137166.	31528.	355.	5.70
10	720.0	3327.	168694.	35002.	393.	5.70
11	730.0	3676.	203696.	38476.	431.	5.70
12	740.0	4021.	242172.	41950.	469.	5.70
13	750.0	4369.	284122.	45424.	507.	5.70
14	760.0	4716.	329546.	48898.	545.	5.70
15	770.0	5063.	378444.	52372.	583.	5.70
16	780.0	5411.	430816.	55846.	621.	5.70
17	790.0	5758.	488662.	59320.	660.	5.70
18	800.0	6106.	545982.	62794.	698.	5.70
19	810.0	6453.	608776.	66268.	736.	5.70
20	820.0	6800.	675043.	69741.	774.	5.70
21	830.0	7148.	744785.	73215.	812.	5.70
22	840.0	7495.	818000.	78471.	850.	5.70
23	850.0	8199.	896471.	85598.	1052.	5.81
24	860.0	8903.	981979.	92545.	1254.	5.91
25	870.0	9606.	1074524.	99582.	1456.	6.02
26	880.0	10310.	1174106.	107038.	1659.	6.13
27	890.0	11098.	1281144.	115893.	1838.	6.26
28	900.0	12081.	1397037.	125727.	1967.	6.45
29	910.0	13064.	1522765.	135561.	2095.	6.64
30	920.0	14048.	1658325.	145395.	2223.	6.83
31	930.0	15031.	1803720.	155228.	2351.	7.02
32	940.0	16015.	1958949.	16502.	2479.	7.21
33	950.0	16998.	2124011.	174896.	2607.	7.40
34	960.0	17981.	2298907.	184730.	2735.	7.59
35	970.0	18965.	2483637.	194564.	2883.	7.78
36	980.0	19948.	2678200.	204397.	2991.	7.97
37	990.0	20931.	2882597.	214231.	3119.	8.16
38	1000.0	21915.	3096828.	221066.	3228.	8.35
39	1010.0	22991.	3317899.	22695.	3400.	8.70
40	1020.0	23099.	3544880.	23695.	3600.	9.10
41	1030.0	24299.	3781865.	25733.	3800.	9.40
42	1040.0	27168.	4039198.	277682.	4000.	9.70
43	1050.0	28368.	4316880.	289682.	4600.	9.80
44	1060.0	29568.	4608562.	301682.	4800.	9.80
45	1070.0	30768.	4908243.	301682.	5000.	9.80

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS. 1	CONS. 2	CONS. 3	NONCONS. 1	NONCONS. 2	NONCONS. 3	O2 SOURCE/SINK	O2 100.00
1	630.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
2	640.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
3	650.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
4	660.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
5	670.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
6	680.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
7	690.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
8	700.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
9	710.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
10	720.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
11	730.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
12	740.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
13	750.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
14	760.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
15	770.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
16	780.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
17	790.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
18	800.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
19	810.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
20	820.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
21	830.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
22	840.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
23	850.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
24	860.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
25	870.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
26	880.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
27	890.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
28	900.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
29	910.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
30	920.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
31	930.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
32	940.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
33	950.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
34	960.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
35	970.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
36	980.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
37	990.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
38	1000.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
39	1010.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
40	1020.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
41	1030.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
42	1040.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
43	1050.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
44	1060.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
45	1070.0	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00

CONSTITUENT NO. 1 IS SPECIFIC CONDUCTANCE
CONSTITUENT NO. 2 IS TOTAL ALKALINITY
CONSTITUENT NO. 3 IS NOT BEING SIMULATED
CONSTITUENT NO. 4 IS NOT BEING SIMULATED
CONSTITUENT NO. 5 IS CARBOINACEOUS BOD
CONSTITUENT NO. 6 IS AMMONIA AS N
CONSTITUENT NO. 7 IS DISSOLVED OXYGEN

DECAY RATES AND CONVERSION FACTORS ARE

CONSTITUENT NO. 4 DECAY RATE = 0.0000
CONSTITUENT NO. 5 DECAY RATE = 0.1000
CONSTITUENT NO. 6 DECAY RATE = 0.0500
CONSTITUENT NO. 5 CONVERSION FACTOR = 1.4650
CONSTITUENT NO. 6 CONVERSION FACTOR = 4.5700

RESERVOIR NUMBER	2	3
CONTROL POINT 1.D.		
LAYER THICKNESS, FT		10.0
MAXIMUM WATER SURFACE ELEVATION, FT	587.5	
BOTTOM ELEVATION, FT	437.5	
STARTING RESERVOIR VOLUME, ACFT	22677.	
SECCHI DISK DEPTH, FT	3.0	
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.00	
FRACTION OF SOLAR ENERGY ABSORBED	0.60	
METEOROLOGICAL DATA ZONE (U/S STREAM SEC.)	47500.	1
WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01	
WATER COLUMN CRITICAL STABILITY (GSNH), KG/M3/M	0.10E-05	
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.30E-04	
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E-09	

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	200.00	248000.00	12	560.00
WET WELL 1	1173.00	15000.00	8	514.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS
1	1.00E+01	1.00E+02
2	5.00E+00	1.00E+02
3	3.00E+00	1.00E+02
6	1.00E+00	1.00E+02
7	3.00E+00	1.00E+02
8	5.00E+00	1.00E+02

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	437.5	50.	0.	594.	40.	9.00
2	447.5	67.	594.	752.	86.	9.00
3	457.5	86.	1346.	920.	132.	9.00
4	467.5	100.	2266.	1088.	178.	9.00
5	477.5	117.	3354.	1256.	226.	9.00
6	487.5	134.	4610.	1426.	270.	9.00
7	497.5	151.	6033.	1592.	315.	9.00
8	507.5	168.	7625.	1760.	361.	9.00
9	517.5	184.	9385.	1933.	407.	9.00
10	527.5	202.	11318.	2182.	452.	9.00
11	537.5	236.	13499.	2454.	486.	9.00
12	547.5	257.	15953.	2631.	513.	9.00
13	557.5	270.	18584.	2761.	539.	9.00
14	567.5	283.	21345.	2891.	565.	9.00
15	577.5	296.	24236.	4648.	591.	9.00
16	587.5	634.	28883.	4648.	1000.	9.00

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS.1	CONS.2	CONS.3	NONCONS.1	NONCONS.2	NONCONS.3	OXYGEN	O2 SOURCE/SINK
1	437.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
2	447.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
3	457.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
4	467.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
5	477.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
6	487.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
7	497.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
8	507.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
9	517.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
10	527.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
11	537.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
12	547.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
13	557.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
14	567.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
15	577.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00
16	587.5	130.00	45.00	0.00	0.00	0.10	0.00	5.0	100.00

CONSTITUENT NO. 1 IS SPECIFIC CONDUCTANCE
CONSTITUENT NO. 2 IS TOTAL ALKALINITY
CONSTITUENT NO. 3 IS NOT BEING SIMULATED
CONSTITUENT NO. 4 IS NOT BEING SIMULATED
CONSTITUENT NO. 5 IS CARBONACEOUS BOD
CONSTITUENT NO. 6 IS AMMONIA AS N
CONSTITUENT NO. 7 IS DISSOLVED OXYGEN

DECAY RATES AND CONVERSION FACTORS ARE

CONSTITUENT NO. 4 DECAY RATE =	0.0000
CONSTITUENT NO. 5 DECAY RATE =	0.1000
CONSTITUENT NO. 6 DECAY RATE =	0.0500
CONSTITUENT NO. 5 CONVERSION FACTOR =	1.4430
CONSTITUENT NO. 6 CONVERSION FACTOR =	4.5700

RESERVOIR NUMBER	3	13
CONTROL POINT I.D.		
LAYER THICKNESS, FT		
MAXIMUM WATER SURFACE ELEVATION, FT	14.0	923.0
BOTTOM ELEVATION, FT	250.0	305953.
STARTING RESERVOIR VOLUME, ACF		
SECCHI DISK DEPTH, FT	10.0	
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	1.00	
FRACTION OF SOLAR ENERGY ABSORBED	0.40	
METEOROLOGICAL DATA ZONE		1
INFLOW I.D. EFFECTIVE RES. LENGTH, FT	2 30000.	
WATER COLUMN MINIMUM STABILITY, KG/M ³ /M		0.10E-01
WATER COLUMN CRITICAL STABILITY (GSMH), KG/M ³ /M		0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M ² /SEC		0.30E-04
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)		-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	180.00	350000.00	47	901.00
WET WELL 1	10.00	4000.00	29	652.00
			34	720.00
			38	788.00
			43	856.00
WET WELL 2	10.00	4000.00	30	669.00
			35	737.00
			40	805.00
			45	873.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT	WEIGHTING	POLYNOMIAL FUNCTION COEFFICIENTS
1	1.00E+01	1.00E+02 0.00E+00 -2.00E+00
2	5.00E+00	1.00E+02 0.00E+00 -1.00E+01
3	3.00E+00	1.00E+02 0.00E+00 -1.00E+01
6	1.00E+00	1.00E+02 0.00E+00 -2.00E+00
7	3.00E+00	1.00E+02 0.00E+00 -1.00E+01
8	5.00E+00	1.00E+02 3.20E+00 -7.00E+01 1.00E-01 -5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL. ACFT	WIDTH FT	TEMPERATURE C
1	250.0	70.	0.	2411.	200.	6.67
2	264.0	132.	2411.	2274.	256.	6.67
3	278.0	193.	4485.	3136.	312.	6.67
4	292.0	255.	7821.	4066.	368.	6.67
5	306.0	326.	11886.	5152.	424.	6.67
6	320.0	410.	17038.	6328.	480.	6.67
7	334.0	494.	23366.	7504.	536.	6.67
8	348.0	578.	30870.	9083.	592.	6.67
9	362.0	720.	39954.	11133.	648.	6.67
10	376.0	871.	51086.	13250.	704.	6.67
11	390.0	1022.	64336.	15434.	760.	6.67
12	404.0	1183.	79770.	17853.	816.	6.67
13	418.0	1348.	97622.	20440.	872.	6.67
14	432.0	1552.	118062.	23027.	928.	6.67
15	446.0	1737.	141090.	26006.	984.	6.67
16	460.0	1978.	167096.	29534.	1004.	6.67
17	474.0	2241.	194630.	33219.	1096.	6.67
18	488.0	2504.	229850.	36882.	1152.	6.67
19	502.0	2764.	266731.	40387.	1208.	6.67
20	516.0	3005.	307118.	43758.	1264.	6.67
21	530.0	3246.	350877.	47150.	1320.	6.67
22	544.0	3487.	398006.	50904.	1376.	6.67
23	558.0	3785.	448910.	55384.	1432.	6.67
24	572.0	4127.	504294.	60166.	1488.	6.67
25	586.0	4468.	564461.	64949.	1544.	6.67
26	600.0	4810.	629610.	69810.	1600.	6.67
27	614.0	5163.	699219.	74769.	1656.	6.67
28	628.0	5516.	773968.	79688.	1712.	6.67
29	642.0	5868.	8534656.	84896.	1768.	6.67
30	656.0	6260.	938552.	90751.	1824.	6.80
31	670.0	6702.	1029283.	96925.	1880.	7.11
32	684.0	7144.	1126208.	103118.	1936.	7.42
33	698.0	7587.	1229326.	109312.	1992.	7.74
34	712.0	8029.	1338638.	115506.	2072.	8.18
35	726.0	8472.	1454144.	121699.	2156.	8.64
36	740.0	8914.	1575863.	128206.	2240.	9.11
37	754.0	9401.	1704050.	135811.	2324.	9.71
38	768.0	10000.	1839861.	144200.	2408.	10.65
39	782.0	10600.	1984061.	152589.	2492.	11.59
40	796.0	11199.	2136650.	160866.	2576.	12.53
41	810.0	11782.	2297515.	168986.	2630.	12.24
42	824.0	12359.	2466501.	177061.	2792.	11.46
43	838.0	12936.	2643562.	185340.	2904.	10.67
44	852.0	13544.	2828922.	195227.	3012.	10.11
45	866.0	14345.	3024149.	206438.	3096.	10.90
46	880.0	15146.	3230587.	217650.	3130.	11.68
47	894.0	15947.	3448237.	198627.	3264.	12.46
48	908.0	16249.	3644864.	126696.	3370.	12.80
49	922.0	5671.	3773560.	3491.		

INITIAL RESERVOIR WATER QUALITY DATA

ELEMENT	ELEV	CONS. 1	CONS. 2	CONS. 3	NONCONS. 1	NONCONS. 2	NONCONS. 3	O2 SOURCE/SINK
1	250.0	62.00	40.00	0.00	0.00	0.00	0.00	100.00
2	264.0	62.00	40.00	0.00	0.00	0.00	0.6	100.00
3	278.0	62.00	40.00	0.00	0.00	0.00	0.8	100.00
4	292.0	62.00	40.00	0.00	0.00	0.00	0.9	100.00
5	306.0	62.00	40.00	0.00	0.00	0.00	1.1	100.00
6	320.0	62.00	40.00	0.00	0.00	0.00	1.2	100.00
7	334.0	62.00	40.00	0.00	0.00	0.00	1.3	100.00
8	348.0	62.00	40.00	0.00	0.00	0.00	1.5	100.00
9	362.0	62.00	40.00	0.00	0.00	0.00	1.6	100.00
10	376.0	62.00	40.00	0.00	0.00	0.00	1.8	100.00
11	390.0	62.00	40.00	0.00	0.00	0.00	1.9	100.00
12	404.0	62.00	40.00	0.00	0.00	0.00	2.0	100.00
13	418.0	62.00	40.00	0.00	0.00	0.00	2.2	100.00
14	432.0	62.00	40.00	0.00	0.00	0.00	2.3	100.00
15	446.0	62.00	40.00	0.00	0.00	0.00	2.5	100.00
16	460.0	62.00	40.00	0.00	0.00	0.00	2.6	100.00
17	474.0	62.00	40.00	0.00	0.00	0.00	2.7	100.00
18	488.0	62.00	40.00	0.00	0.00	0.00	2.9	100.00
19	502.0	62.00	40.00	0.00	0.00	0.00	3.0	100.00
20	516.0	62.00	40.00	0.00	0.00	0.00	3.2	100.00
21	530.0	62.00	40.00	0.00	0.00	0.00	3.3	100.00
22	544.0	62.00	40.00	0.00	0.00	0.00	3.4	100.00
23	558.0	62.00	40.00	0.00	0.00	0.00	3.6	100.00
24	572.0	62.00	40.00	0.00	0.00	0.00	3.7	100.00
25	586.0	62.00	40.00	0.00	0.00	0.00	3.9	100.00
26	600.0	62.00	40.00	0.00	0.00	0.00	4.0	100.00
27	614.0	62.00	40.00	0.00	0.00	0.00	4.3	100.00
28	628.0	62.00	40.00	0.00	0.00	0.00	4.6	100.00
29	642.0	62.00	40.00	0.00	0.00	0.00	4.8	100.00
30	656.0	62.00	40.00	0.00	0.00	0.00	5.1	100.00
31	670.0	62.00	40.00	0.00	0.00	0.00	5.4	100.00
32	684.0	62.00	40.00	0.00	0.00	0.00	5.7	100.00
33	698.0	62.00	40.00	0.00	0.00	0.00	6.0	100.00
34	712.0	62.00	40.00	0.00	0.00	0.00	6.2	100.00
35	726.0	62.00	40.00	0.00	0.00	0.00	6.5	100.00
36	740.0	62.00	40.00	0.00	0.00	0.00	6.8	100.00
37	754.0	62.00	40.00	0.00	0.00	0.00	7.1	100.00
38	768.0	62.00	40.00	0.00	0.00	0.00	7.4	100.00
39	782.0	62.00	40.00	0.00	0.00	0.00	7.6	100.00
40	796.0	62.00	40.00	0.00	0.00	0.00	7.9	100.00
41	810.0	62.00	40.00	0.00	0.00	0.00	8.2	100.00
42	824.0	62.00	40.00	0.00	0.00	0.00	8.5	100.00
43	838.0	62.00	40.00	0.00	0.00	0.00	8.8	100.00
44	852.0	62.00	40.00	0.00	0.00	0.00	9.0	100.00
45	866.0	62.00	40.00	0.00	0.00	0.00	9.3	100.00
46	880.0	62.00	40.00	0.00	0.00	0.00	9.6	100.00
47	894.0	62.00	40.00	0.00	0.00	0.00	9.9	100.00
48	908.0	62.00	40.00	0.00	0.00	0.00	10.0	100.00
49	922.0	62.00	40.00	0.00	0.00	0.00	10.0	100.00

CONSTITUENT NO. 1 IS SPECIFIC CONDUCTANCE
CONSTITUENT NO. 2 IS TOTAL ALKALINITY
CONSTITUENT NO. 3 IS NOT BEING SIMULATED
CONSTITUENT NO. 4 IS NOT BEING SIMULATED
CONSTITUENT NO. 5 IS CARBONACEOUS BOD
CONSTITUENT NO. 6 IS AMMONIA AS N
CONSTITUENT NO. 7 IS DISSOLVED OXYGEN

DECAY RATES AND CONVERSION FACTORS ARE

CONSTITUENT NO. 4 DECAY RATE = 0.0000
CONSTITUENT NO. 5 DECAY RATE = 0.1000
CONSTITUENT NO. 6 DECAY RATE = 0.0500
CONSTITUENT NO. 5 CONVERSION FACTOR = 1.4630
CONSTITUENT NO. 6 CONVERSION FACTOR = 4.5700

RESERVOIR NUMBER 4

CONTROL POINT I.D.

20

LAYER THICKNESS, FT	7.0
MAXIMUM WATER SURFACE ELEVATION, FT	480.0
BOTTOM ELEVATION, FT	225.0
STARTING RESERVOIR VOLUME, ACF	832100.
SECCHI DISK DEPTH, FT	12.0
DEPTH OF INITIAL SOLAR ENERGY ABSORPTION, FT	2.00
FRACTION OF SOLAR ENERGY ABSORBED	0.40
METEOROLOGICAL DATA ZONE	1
INFLOW I.D.	3
EFFECTIVE RES. LENGTH, FT	264.00
WATER COLUMN MINIMUM STABILITY, KG/M3/M	0.10E-01
WATER COLUMN CRITICAL STABILITY (CSWR), KG/M3/M	0.10E-05
MAXIMUM ALLOWABLE DISPERSION (A1), M2/SEC	0.10E-03
COEFFICIENT RELATING GRADIENT TO DISPERSION (A3)	-0.70E+00

OUTLET CHARACTERISTICS

	VIRTUAL WIDTH, FT	MAXIMUM FLOW, CFS	ELEMENT	ELEVATION, FT
SPILLWAY	336.00	567000.00	28	418.00
WET WELL 1	10.40	8000.00	12	307.00

GATE SELECTION SUBOPTIMIZATION FUNCTION

CONSTITUENT WEIGHTING POLYNOMIAL FUNCTION COEFFICIENTS

1	1.00E+01	1.00E+02	0.00E+00	-2.00E+00
2	5.00E+00	1.00E+02	0.00E+00	-1.00E-01
3	3.00E+00	1.00E+02	0.00E+00	-1.00E-01
6	1.00E+00	1.00E+02	0.00E+00	-2.00E-00
7	3.00E+00	1.00E+02	0.00E+00	-1.00E-01
8	5.00E+00	1.00E+02	3.20E+00	-7.00E-01
			1.00E-01	-5.00E-03

RESERVOIR GEOMETRY AND INITIAL TEMPERATURE

ELEMENT	ELEVATION FT	AREA ACRE	VOLUME ACFT	ELEMENT VOL ACFT	WIDTH FT	TEMPERATURE C
1	225.0	90.	0.	2002.	100.	8.00
2	232.0	196.	2002.	1747.	212.	8.00
3	239.0	303.	3750.	2492.	324.	8.00
4	246.0	409.	6262.	3220.	436.	8.00
5	253.0	511.	9462.	3909.	560.	8.06
6	260.0	606.	13370.	4575.	700.	8.20
7	267.0	701.	17946.	5242.	840.	8.34
8	274.0	796.	23187.	5942.	980.	8.48
9	281.0	901.	29129.	6681.	1240.	8.50
10	288.0	1008.	35910.	7426.	1520.	8.50
11	295.0	1114.	43235.	8294.	1800.	8.50
12	302.0	1256.	51529.	9593.	2080.	8.54
13	309.0	1485.	61122.	11200.	2360.	8.68
14	316.0	1715.	72322.	12807.	2640.	8.82
15	323.0	1944.	85129.	14554.	2920.	8.96
16	330.0	2214.	99683.	16498.	3200.	9.06
17	337.0	2500.	116181.	18497.	3480.	9.14
18	344.0	2785.	134678.	20614.	3760.	9.23
19	351.0	3104.	155291.	23554.	4040.	9.33
20	358.0	3425.	178845.	27199.	4320.	9.52
21	365.0	4146.	206044.	30845.	4600.	9.72
22	372.0	4667.	236889.	34558.	4880.	9.92
23	379.0	5207.	271446.	38388.	5160.	10.43
24	386.0	5761.	309834.	42269.	5440.	11.19
25	393.0	6316.	352103.	46150.	5720.	11.94
26	400.0	6870.	398253.	50107.	6000.	12.70
27	407.0	7446.	448360.	54142.	6389.	12.93
28	414.0	8023.	502503.	57984.	6778.	13.17
29	421.0	8544.	560487.	61374.	7094.	13.30
30	428.0	8991.	621861.	64506.	7312.	13.30
31	435.0	9439.	686367.	67639.	7531.	13.30
32	442.0	9886.	754006.	70771.	7750.	13.30
33	449.0	10334.	824776.	73908.	7969.	13.30
34	456.0	10783.	898685.	77052.	8240.	13.30
35	463.0	11232.	975737.	80197.	8520.	13.30
36	470.0	11681.	1055934.	83446.	8800.	13.30
37	477.0	12160.	1139380.	83446.	9400.	13.30

INITIAL RESERVOIR WATER QUALITY DATA

	ELEMENT	ELEV	CONS.1	MONCONS.1	NONCONS.1	OXYGEN	SOURCE/SINK
1	225.0	70.00	20.00	0.00	0.00	10.00	02
2	232.0	70.00	20.00	0.00	0.00	10.00	
3	239.0	70.00	20.00	0.00	0.00	10.00	
4	246.0	70.00	20.00	0.00	0.00	10.00	
5	253.0	70.00	20.00	0.00	0.00	10.00	
6	260.0	70.00	20.00	0.00	0.00	10.00	
7	267.0	70.00	20.00	0.00	0.00	10.00	
8	274.0	70.00	20.00	0.00	0.00	10.00	
9	281.0	70.00	20.00	0.00	0.00	10.00	
10	288.0	70.00	20.00	0.00	0.00	10.00	
11	295.0	70.00	20.00	0.00	0.00	10.00	
12	302.0	70.00	20.00	0.00	0.00	10.00	
13	309.0	70.00	20.00	0.00	0.00	10.00	
14	316.0	70.00	20.00	0.00	0.00	10.00	
15	323.0	70.00	20.00	0.00	0.00	10.00	
16	330.0	70.00	20.00	0.00	0.00	10.00	
17	337.0	70.00	20.00	0.00	0.00	10.00	
18	344.0	70.00	20.00	0.00	0.00	10.00	
19	351.0	70.00	20.00	0.00	0.00	10.00	
20	358.0	70.00	20.00	0.00	0.00	10.00	
21	365.0	70.00	20.00	0.00	0.00	10.00	
22	372.0	70.00	20.00	0.00	0.00	10.00	
23	379.0	70.00	20.00	0.00	0.00	10.00	
24	386.0	70.00	20.00	0.00	0.00	10.00	
25	393.0	70.00	20.00	0.00	0.00	10.00	
26	400.0	70.00	20.00	0.00	0.00	10.00	
27	407.0	70.00	20.00	0.00	0.00	10.00	
28	414.0	70.00	20.00	0.00	0.00	10.00	
29	421.0	70.00	20.00	0.00	0.00	10.00	
30	428.0	70.00	20.00	0.00	0.00	10.00	
31	435.0	70.00	20.00	0.00	0.00	10.00	
32	442.0	70.00	20.00	0.00	0.00	10.00	
33	449.0	70.00	20.00	0.00	0.00	10.00	
34	456.0	70.00	20.00	0.00	0.00	10.00	
35	463.0	70.00	20.00	0.00	0.00	10.00	
36	470.0	70.00	20.00	0.00	0.00	10.00	
37	477.0	70.00	20.00	0.00	0.00	10.00	

CONSTITUENT NO. 1 IS SPECIFIC CONDUCTANCE
CONSTITUENT NO. 2 IS TOTAL ALKALINITY
CONSTITUENT NO. 3 IS NOT SIMULATED
CONSTITUENT NO. 4 IS NOT BEING SIMULATED
CONSTITUENT NO. 5 IS CARBONACEOUS BOD
CONSTITUENT NO. 6 IS AMMONIA AS N
CONSTITUENT NO. 7 IS DISSOLVED OXYGEN

DECAY RATES AND CONVERSION FACTORS ARE

CONSTITUENT NO. 4 DECAY RATE = 0.0000
CONSTITUENT NO. 5 DECAY RATE = 0.1000
CONSTITUENT NO. 6 DECAY RATE = 0.0500
CONSTITUENT NO. 5 CONVERSION FACTOR = 1.4530
CONSTITUENT NO. 6 CONVERSION FACTOR = 4.5700

THERMAL ADJUSTMENT FACTORS FOR

CONSTITUENT NO. 4 DECAY RATE = 1.0470
CONSTITUENT NO. 5 DECAY RATE = 1.0470
CONSTITUENT NO. 6 DECAY RATE = 1.0470
OXYGEN REAERATION RATE = 1.0159

STREAM RELATED DATA

PRINTOUT INTERVAL, DAYS 30
 PRINTOUT INTERVAL, ELEMENTS 1
 CROSS SECTION PRINT CONTROL 0
 NUMBER OF CROSS SECTIONS 95
 POINTS DEFINING CROSS SECTION GEOMETRY 21
 X-SECTION WIDTH ADJUSTMENT RATIO 1.00

STREAM REACH DATA

REACH	UP STREAM CP.	UP STREAM LOC.	DOWN STREAM CP.	DOWN STREAM LOC.	ELT LENGTH MILE	TRIB LOCATIONS AND NUMBER
1	1	303.8	2	300.0	1.90	300.0 4 0.0
2	3	294.6	4	275.9	4.66	280.1 5 0.0
3	4	275.9	5	271.3	2.33	273.2 6 0.0
4	5	271.3	6	262.0	4.66	271.2 7 0.0
5	6	262.0	7	243.3	4.66	0.0 0.0
6	7	243.3	8	206.0	4.66	225.1 8 0.0
7	8	206.0	9	196.7	4.66	0.0 0.0
8	9	196.7	10	168.8	4.66	0.0 0.0
9	10	168.8	11	140.8	4.66	0.0 0.0
10	11	140.8	12	117.5	4.66	0.0 0.0
11	12	117.5	19	80.2	4.66	0.0 0.0
12	13	75.4	14	71.8	1.78	75.0 9 0.0
13	14	71.8	15	58.8	3.25	58.8 9 0.0
14	15	58.8	16	45.6	3.32	0.0 0.0
15	16	45.6	17	26.3	2.41	29.7 10 0.0
16	17	26.3	18	6.6	4.37	12.3 11 0.0
17	18	8.8	19	0.0	4.38	0.0 0.0
18	19	80.2	22	59.6	4.12	0.0 0.0
19	20	28.5	21	20.9	2.53	0.0 0.0
20	21	20.9	22	0.0	4.19	0.0 0.0
21	22	59.6	23	38.3	2.67	0.0 0.0

METEOROLOGICAL AND REAERATION CONTROLS

ELEMENT	LOCATION	MET. ZONE	K2 METHOD	K2(LIF SET)	POINT K2
1	302.85	1	(OCONNER AND DORBINS)		
2	300.95	2	(OCONNER AND DORBINS)		
3	292.25	3	(OCONNER AND DORBINS)		
4	287.59	1	(OCONNER AND DORBINS)		
5	282.93	1	(OCONNER AND DORBINS)		
6	278.27	4	(OCONNER AND DORBINS)		
7	274.77	4	(OCONNER AND DORBINS)		
8	272.44	5	(OCONNER AND DORBINS)		
9	268.95	5	(OCONNER AND DORBINS)		
10	264.29	6	(OCONNER AND DORBINS)		
11	259.63	6	(OCONNER AND DORBINS)		
12	254.97	1	(OCONNER AND DORBINS)		
13	250.31	1	(OCONNER AND DORBINS)		
14	245.65	7	(OCONNER AND DORBINS)		

15	240.99	7		1	(COONER AND DOBBINS)
16	236.33			1	(COONER AND DOBBINS)
17	231.67			1	(COONER AND DOBBINS)
18	227.01			1	(COONER AND DOBBINS)
19	222.35			1	(COONER AND DOBBINS)
20	217.69			1	(COONER AND DOBBINS)
21	213.03			1	(COONER AND DOBBINS)
22	208.37	6		1	(COONER AND DOBBINS)
23	203.71	8		1	(COONER AND DOBBINS)
24	199.05	9		1	(COONER AND DOBBINS)
25	194.39	9		1	(COONER AND DOBBINS)
26	189.73			1	(COONER AND DOBBINS)
27	185.07			1	(COONER AND DOBBINS)
28	180.41			1	(COONER AND DOBBINS)
29	175.75			1	(COONER AND DOBBINS)
30	171.09	10		1	(COONER AND DOBBINS)
31	166.43	10		1	(COONER AND DOBBINS)
32	161.77			1	(COONER AND DOBBINS)
33	157.11			1	(COONER AND DOBBINS)
34	152.45			1	(COONER AND DOBBINS)
35	147.79			1	(COONER AND DOBBINS)
36	143.13	11		1	(COONER AND DOBBINS)
37	138.47	11		1	(COONER AND DOBBINS)
38	133.81			1	(COONER AND DOBBINS)
39	129.15			1	(COONER AND DOBBINS)
40	124.49			1	(COONER AND DOBBINS)
41	119.83	12		1	(COONER AND DOBBINS)
42	115.17	12		1	(COONER AND DOBBINS)
43	110.51			1	(COONER AND DOBBINS)
44	105.85			1	(COONER AND DOBBINS)
45	101.19			1	(COONER AND DOBBINS)
46	96.53			1	(COONER AND DOBBINS)
47	91.87			1	(COONER AND DOBBINS)
48	87.21			1	(COONER AND DOBBINS)
49	82.55	19		1	(COONER AND DOBBINS)
50	78.89			1	(COONER AND DOBBINS)
51	75.23	13		1	(COONER AND DOBBINS)
52	72.71	14		1	(COONER AND DOBBINS)
53	70.20	14		1	(COONER AND DOBBINS)
54	66.95			1	(COONER AND DOBBINS)
55	63.71			1	(COONER AND DOBBINS)
56	60.46	15		1	(COONER AND DOBBINS)
57	57.18	15		1	(COONER AND DOBBINS)
58	53.86			1	(COONER AND DOBBINS)
59	50.54			1	(COONER AND DOBBINS)
60	47.22	16		1	(COONER AND DOBBINS)
61	44.35	16		1	(COONER AND DOBBINS)
62	41.94			1	(COONER AND DOBBINS)
63	39.53			1	(COONER AND DOBBINS)
64	37.11			1	(COONER AND DOBBINS)
65	34.70			1	(COONER AND DOBBINS)
66	32.28			1	(COONER AND DOBBINS)
67	29.87			1	(COONER AND DOBBINS)
68	27.46	17		1	(COONER AND DOBBINS)
69	24.06	17		1	(COONER AND DOBBINS)
	19.69			1	(COONER AND DOBBINS)

15.32	18	1	(COONER AND DOBBINS)
10.95	18	1	(COONER AND DOBBINS)
6.57	18	1	(COONER AND DOBBINS)
72	2.19	19	(COONER AND DOBBINS)
73	78.16	19	(COONER AND DOBBINS)
74	74.05	1	(COONER AND DOBBINS)
75	69.93	1	(COONER AND DOBBINS)
76	65.81	1	(COONER AND DOBBINS)
77	18.84	21	(COONER AND DOBBINS)
78	61.70	22	(COONER AND DOBBINS)
79	27.26	20	(COONER AND DOBBINS)
80	24.73	22	(COONER AND DOBBINS)
81	22.20	21	(COONER AND DOBBINS)
82	14.65	1	(COONER AND DOBBINS)
83	10.46	1	(COONER AND DOBBINS)
84	6.28	1	(COONER AND DOBBINS)
85	2.09	22	(COONER AND DOBBINS)
86	58.31	22	(COONER AND DOBBINS)
87	55.64	1	(COONER AND DOBBINS)
88	52.97	1	(COONER AND DOBBINS)
89	50.30	1	(COONER AND DOBBINS)
90	47.63	1	(COONER AND DOBBINS)
91	44.96	1	(COONER AND DOBBINS)
92	42.29	1	(COONER AND DOBBINS)
93	39.62	23	(COONER AND DOBBINS)

*** WARNING *** ZERO HYDRAULIC SLOPE BETWEEN CROSS-SECTIONS 51 AND 52
***** SLOPE SET TO .0001 *****
*** WARNING *** ZERO HYDRAULIC SLOPE BETWEEN CROSS-SECTIONS 49 AND 75
***** SLOPE SET TO .0001 *****

REACH NO	DECAY RATES FOR STREAM REACHES		
	CONS 4	CONS 5	CONS 6
1	0.100	0.100	0.050
2	0.100	0.100	0.050
3	0.100	0.100	0.050
4	0.100	0.100	0.050
5	0.100	0.100	0.050
6	0.100	0.100	0.050
7	0.100	0.100	0.050
8	0.100	0.100	0.050
9	0.100	0.100	0.050
10	0.100	0.100	0.050
11	0.100	0.100	0.050
12	0.100	0.100	0.050
13	0.100	0.100	0.050
14	0.100	0.100	0.050
15	0.100	0.100	0.050
16	0.100	0.100	0.050
17	0.100	0.100	0.050
18	0.100	0.100	0.050
19	0.100	0.100	0.050
20	0.100	0.100	0.050
21	0.100	0.100	0.050

CONTROL POINT 1

TEMPERATURE OBJECTIVES, C		WEIGHTING	RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION CONTROL			
DATE	TARGET	1.00	0.00	0	0	0
790401	12.00	1.00	0.00	0	0	0
-791031	12.00	1.00	0.00	0	0	0

SPECIFIC CONDUCTANCE		WEIGHTING	RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION CONTROL			
DATE	TARGET	1.00	0.00	0	0	0
790401	130.00	1.00	0.00	0	0	0
-791031	130.00	1.00	0.00	0	0	0

TOTAL ALKALINITY

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	60.00	1.00	0.00	0.00	0.00	0.00
-791031	60.00	1.00	0.00	0.00	0.00	0.00

CARBONACEOUS BOD

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	5.00	1.00	0.00	0.00	0.00	0.00
-791031	5.00	1.00	0.00	0.00	0.00	0.00

AMMONIA AS N

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	0.10	1.00	0.00	0.00	0.00	0.00
-791031	0.10	1.00	0.00	0.00	0.00	0.00

DISSOLVED OXYGEN

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	5.00	0.00	1.00	0.00	0.00	0.00
-791031	5.00	0.00	1.00	0.00	0.00	0.00

CONTROL POINT 2

TEMPERATURE OBJECTIVES, C

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	12.00	1.00	0.00	0.00	0	0
-791031	12.00	1.00	0.00	0.00	0	0

SPECIFIC CONDUCTANCE

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	130.00	1.00	0.00	0.00	0	0
-791031	130.00	1.00	0.00	0.00	0	0

TOTAL ALKALINITY

DATE	TARGET	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING	WEIGHTING
790401	60.00	1.00	0.00	0.00	0	0
-791031	60.00	1.00	0.00	0.00	0	0

Most of the Control Point Target records (CT)
have been deleted from this listing.

CONTROL POINT 23

TEMPERATURE OBJECTIVES, C	DATE	TARGET	WEIGHTING	RESERVOIRS SPECIFIED FOR FLOW AUGMENTATION	CONTROL
	790401	14.00	1.00	0.00	0 0
	790516	19.00	1.00	0.00	0 0
	790614	21.50	1.00	0.00	0 0
	790726	22.50	1.00	0.00	0 0
	790823	21.00	1.00	0.00	0 0
	790913	21.50	1.00	0.00	0 0
	791031	19.00	1.00	0.00	0 0

SPECIFIC CONDUCTANCE

DATE	TARGET	WEIGHTING	WEIGHTING
790401	150.00	1.00	0.00
790515	130.00	1.00	0.00
790612	148.00	1.00	0.00
790726	130.00	1.00	0.00
790823	157.00	1.00	0.00
790913	189.00	1.00	0.00
791031	190.00	1.00	0.00

TOTAL ALKALINITY

DATE	TARGET	WEIGHTING	WEIGHTING
790401	64.00	1.00	0.00
790515	43.00	1.00	0.00
790612	51.00	1.00	0.00
790726	48.00	1.00	0.00
790823	69.00	1.00	0.00
790913	72.00	1.00	0.00
791031	72.00	1.00	0.00

790401
791031
214
FIRST DAY OF INFLOW QUALITY RECORD
LAST DAY OF INFLOW QUALITY RECORD
TOTAL NUMBER OF DAYS

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TRIB 1    1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
TRIB 1    1 CARDS READ FOR SHASTA INFLOW EC
TRIB 1    2 CARDS READ FOR SHASTA INFLOW DO
TRIB 1    2 CARDS READ FOR SHASTA INFLOW ALKALINITY
TRIB 1    1 CARDS READ FOR SHASTA INFLOW BOD
TRIB 1    2 CARDS READ FOR SHASTA INFLOW NH3
TRIB 1    1 CARDS READ FOR SHASTA INFLOW DO
TRIB 1    2 CARDS READ FOR SHASTA INFLOW EC
TRIB 2    1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
TRIB 2    2 CARDS READ FOR CROVILLE INFLOW EC
TRIB 2    1 CARDS READ FOR CROVILLE INFLOW DO
TRIB 2    2 CARDS READ FOR CROVILLE INFLOW BOD
TRIB 2    1 CARDS READ FOR CROVILLE INFLOW AMMONIA
TRIB 2    2 CARDS READ FOR CROVILLE INFLOW DISOLVED OXYGEN
TRIB 2    1 CARDS READ FOR CROVILLE INFLOW = TOTAL LOCAL FLOW
TRIB 3    1 CARDS READ FOR OROVILLE INFLOW EC
TRIB 3    2 CARDS READ FOR OROVILLE INFLOW DO
TRIB 3    1 CARDS READ FOR OROVILLE INFLOW BOD
TRIB 3    2 CARDS READ FOR OROVILLE INFLOW AMMONIA
TRIB 3    1 CARDS READ FOR OROVILLE INFLOW = TOTAL LOCAL FLOW
TRIB 3    2 CARDS READ FOR FOLSOM INFLOW EC
TRIB 3    2 CARDS READ FOR FOLSOM INFLOW DO
TRIB 3    1 CARDS READ FOR FOLSOM INFLOW BOD
TRIB 3    2 CARDS READ FOR FOLSOM INFLOW AMMONIA
TRIB 3    3 CARDS READ FOR FOLSOM INFLOW DO
TRIB 3    1 CARDS READ FOR SPRING CR. INFLOW
TRIB 4    1 CARDS READ FOR SPRING CR. DO
TRIB 4    1 CARDS READ FOR SPRING CR. EC
TRIB 4    1 CARDS READ FOR SPRING CR. ALKALINITY
TRIB 4    1 CARDS READ FOR COM CR. EC
TRIB 4    1 CARDS READ FOR COM CR. DO
TRIB 4    1 CARDS READ FOR COM CR. BOD
TRIB 4    1 CARDS READ FOR COM CR. NH3
TRIB 5    1 CARDS READ FOR COM CR. DO
TRIB 5    1 CARDS READ FOR COM CR. BOD
TRIB 5    1 CARDS READ FOR COM CR. EC
TRIB 5    1 CARDS READ FOR COM CR. NH3
TRIB 5    1 CARDS READ FOR COTTONWOOD CR. DO
TRIB 5    1 CARDS READ FOR COTTONWOOD CR. EC
TRIB 5    1 CARDS READ FOR COTTONWOOD CR. ALKALINITY
TRIB 5    1 CARDS READ FOR COTTONWOOD CR. BOD
TRIB 6    1 CARDS READ FOR COTTONWOOD CR. NH3
TRIB 6    1 CARDS READ FOR COTTONWOOD CR. DO
TRIB 6    1 CARDS READ FOR COTTONWOOD CR. EC
TRIB 6    1 CARDS READ FOR COTTONWOOD CR. ALKALINITY
TRIB 6    1 CARDS READ FOR COTTONWOOD CR. BOD
TRIB 7    1 CARDS READ FOR BATTLE CR. DO
TRIB 7    1 CARDS READ FOR BATTLE CR. BOD
TRIB 7    1 CARDS READ FOR BATTLE CR. NH3
TRIB 7    1 CARDS READ FOR BATTLE CR. EC

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TRIB 8 ... 1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. INFLOW (RTO = 1.00)
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. EC
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. ALKALINITY
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. BOD
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. NH3
 TRIB 8 ... 1 CARDS READ FOR THOMES CR. DO (RTO = 1.00)
 TRIB 9 ... 1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
 TRIB 9 ... 2 CARDS READ FOR BYPASSED FEATHER RIVER
 TRIB 9 ... 2 CARDS READ FOR BYPASSED FEATHER RIVER EC
 TRIB 9 ... 1 CARDS READ FOR BYPASSED FEATHER RIVER ALKALINITY
 TRIB 9 ... 1 CARDS READ FOR BYPASSED FEATHER RIVER BOD
 TRIB 9 ... 2 CARDS READ FOR BYPASSED FEATHER RIVER AMMONIA
 TRIB 9 ... 2 CARDS READ FOR BYPASSED FEATHER RIVER DISSOLVED OXYGEN
 TRIB 10 ... 1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER EC
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER DO
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER EC
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER ALKALINITY
 TRIB 10 ... 1 CARDS READ FOR YUBA RIVER BOD
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER AMMONIA
 TRIB 10 ... 3 CARDS READ FOR YUBA RIVER DO
 TRIB 11 ... 1 CARDS READ FOR INFLOW = TOTAL LOCAL FLOW
 TRIB 11 ... 3 CARDS READ FOR BEAR RIVER
 TRIB 11 ... 3 CARDS READ FOR BEAR RIVER EC
 TRIB 11 ... 3 CARDS READ FOR BEAR RIVER BOD
 TRIB 11 ... 3 CARDS READ FOR BEAR RIVER AMMONIA
 TRIB 11 ... 1 CARDS READ FOR BEAR RIVER DO
 TRIB 11 ... 1 CARDS READ FOR BEAR RIVER BOD
 TRIB 11 ... 2 CARDS READ FOR BEAR RIVER DO

TIME (YEAR/MONTH/DAY/HOUR) VS. INFLOW QUALITY AT CONTROL POINTS

TRIB	1 ...	INFLOW = TOTAL LOCAL FLOW			INFLOW RATE AS FRACTION OF LOCAL FLOW			TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE			SPECIFIC CONDUCTANCE			TOTAL ALKALINITY			CARBOVACUOUS BOD			AMMONIA AS N		
		TIME	VALUE	TIME	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	TIME	
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00					79/11/ 1/ 0	-5.00													
TRIB 1 ... SHASTA INFLOW EC																						
79/ 4/ 2/ 0	120.00	79/ 5/30/ 0	120.00	79/ 7/17/ 0	140.00	79/10/12/ 0	120.00	79/11/ 1/ 0	120.00	79/ 9/12/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0		
TRIB 1 ... SHASTA INFLOW BOD																						
79/ 4/ 2/ 0	55.00	79/ 5/ 3/ 0	55.00	79/ 5/30/ 0	45.00	79/ 7/17/ 0	50.00	79/11/ 1/ 0	50.00	79/ 9/12/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0	64.00	79/11/ 1/ 0		
TRIB 1 ... SHASTA INFLOW NH3																						
79/ 4/ 2/ 0	0.00	79/ 7/17/ 0	0.02	79/ 9/20/ 0	0.03	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00	79/11/ 1/ 0	0.00			

TRIB 1 ... SHASTA INFLOW DO				DISSOLVED OXYGEN AS PERCENT SATURATION			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	100.00	79/11/ 1/ 0	100.00				
TRIB 2 ... INFLOW = TOTAL LOCAL FLOW				INFLOW RATE AS FRACTION OF LOCAL FLOW			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00				
TRIB 2 ... OROVILLE INFLOW				TEMPERATURE, C			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	12.80	79/ 7/ 2/ 0	14.00	79/ 7/19/ 0	18.30	79/ 8/ 2/ 0	12.00
79/11/ 1/ 0	4.44						
TRIB 2 ... OROVILLE INFLOW EC				SPECIFIC CONDUCTANCE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	62.00	79/ 7/19/ 0	60.00	79/11/ 1/ 0	60.00		
TRIB 2 ... OROVILLE INFLOW ALKALINITY				TOTAL ALKALINITY			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	150.00	79/11/ 1/ 0	150.00				
TRIB 2 ... OROVILLE INFLOW BOD				CARBONACEOUS BOD			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	5.00	79/11/ 1/ 0	5.00				
TRIB 2 ... OROVILLE INFLOW AMMONIA				AMMONIA AS N			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.01	79/ 7/19/ 0	0.00	79/11/ 1/ 0	0.00		
TRIB 2 ... OROVILLE INFLOW DISSOLVED OXYGEN				DISSOLVED OXYGEN, MG/L			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	10.40	79/ 7/19/ 0	8.50	79/11/ 1/ 0	8.50		
TRIB 3 ... INFLOW = TOTAL LOCAL FLOW				INFLOW RATE AS FRACTION OF LOCAL FLOW			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00				
TRIB 3 ... FOLSOM INFLOW EC				TEMPERATURE, C			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	8.00	79/ 5/31/ 0	14.00	79/ 7/28/ 0	14.00	79/10/23/ 0	15.00
TRIB 3 ... FOLSOM INFLOW				SPECIFIC CONDUCTANCE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	74.00	79/ 5/17/ 0	71.00	79/ 6/15/ 0	76.00	79/ 7/19/ 0	74.00
79/11/ 1/ 0	61.00						
TRIB 3 ... FOLSOM INFLOW ALKALINITY				TOTAL ALKALINITY			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	20.00	79/ 5/31/ 0	13.00	79/ 7/28/ 0	19.00	79/11/ 1/ 0	19.00
TRIB 3 ... FOLSOM INFLOW BOD				CARBONACEOUS BOD			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	5.00	79/11/ 1/ 0	5.00				

TRIB 3 ...		FOLSOM INFLOW AMMONIA		AMMONIA AS N							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.01	79/ 5/31/ 0	0.09	79/ 7/19/ 0	0.02	79/ 7/28/ 0	0.00	79/ 8/ 0	0.01	79/11/ 1/ 0	0.01
TRIB 3 ...		FOLSOM INFLOW DO		DISSOLVED OXYGEN, MG/L							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	10.70	79/ 5/17/ 0	9.40	79/ 5/31/ 0	10.60	79/ 6/15/ 0	9.10	79/ 7/19/ 0	9.50	79/ 7/28/ 0	10.00
79/ 8/ 0	7.90	79/ 9/12/ 0	8.60	79/ 11/ 1/ 0	10.60						
TRIB 4 ...		INFLOW = TOTAL LOCAL FLOW		INFLOW RATE AS FRACTION OF LOCAL FLOW							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00								
TRIB 4 ...		SPRING CR. INFLOW		TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-5.00	79/ 7/ 8/ 0	-2.00	79/11/ 1/ 0	-7.00						
TRIB 4 ...		SPRING CR. EC		SPECIFIC CONDUCTANCE							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	200.00	79/11/ 1/ 0	200.00								
TRIB 4 ...		SPRING CR. ALKALINITY		TOTAL ALKALINITY							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	55.00	79/11/ 1/ 0	55.00								
TRIB 4 ...		SPRING CR. BOD		CARBOGANEOUS BOD							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 4 ...		SPRING CR. NH3		AMMONIA AS N							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 4 ...		SPRING CR. DO		DISSOLVED OXYGEN AS PERCENT SATURATION							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	125.00	79/11/ 1/ 0	125.00								
TRIB 5 ...		INFLOW = TOTAL LOCAL FLOW		INFLOW RATE AS FRACTION OF LOCAL FLOW							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00								
TRIB 5 ...		CON CR. INFLOW		TEMPERATURE (C) AS DEPARTURE FROM EQUILIBRIUM TEMPERATURE							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/ 7/ 8/ 0	-2.00	79/11/ 1/ 0	-7.00						
TRIB 5 ...		CON CR. EC		SPECIFIC CONDUCTANCE							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	200.00	79/11/ 1/ 0	200.00								
TRIB 5 ...		CON CR. ALKALINITY		TOTAL ALKALINITY							
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	100.00	79/11/ 1/ 0	100.00								

TRIB 5 ...	CON CR. BOD	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 5 ...	CON CR. NH3	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 5 ...	CON CR. DO	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	135.00	79/11/ 1/ 0	135.00								
TRIB 6 ...	INFLOW = TOTAL LOCAL FLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00								
TRIB 6 ...	COTTONWOOD CR. INFLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/ 7/ 8/ 0	-2.00	79/11/ 1/ 0	-7.00						
TRIB 6 ...	COTTONWOOD CR. EC	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	200.00	79/11/ 1/ 0	200.00								
TRIB 6 ...	COTTONWOOD CR. ALKALINITY	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	100.00	79/11/ 1/ 0	100.00								
TRIB 6 ...	COTTONWOOD CR. BOD	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 6 ...	COTTONWOOD CR. NH3	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 6 ...	COTTONWOOD CR. DO	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	135.00	79/11/ 1/ 0	135.00								
TRIB 7 ...	INFLOW = TOTAL LOCAL FLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00								
TRIB 7 ...	BATTLE CR. INFLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/ 7/ 8/ 0	-2.00	79/11/ 1/ 0	-7.00						
TRIB 7 ...	BATTLE CR. EC	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	200.00	79/11/ 1/ 0	200.00								
TRIB 7 ...	BATTLE CR. ALKALINITY	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	100.00	79/11/ 1/ 0	100.00								
TRIB 7 ...	BATTLE CR. BOD	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 7 ...	BATTLE CR. NH3	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00								
TRIB 7 ...	BATTLE CR. DO	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
79/ 4/ 2/ 0	135.00	79/11/ 1/ 0	135.00								

TRIB	7	...	BATTLE CR.	BOD	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
	79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00												
TRIB	7	...	BATTLE CR.	NH ₃	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
	79/ 4/ 2/ 0	0.00	79/11/ 1/ 0	0.00												
TRIB	7	...	BATTLE CR.	DO	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE
	79/ 4/ 2/ 0	135.00	79/11/ 1/ 0	135.00												
TRIB	8	...	INFLOW = TOTAL LOCAL FLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00												
TRIB	8	...	THOMES CR. INFLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	5.00	79/ 6/26/ 0	9.00	79/11/ 1/ 0	5.00		79/11/ 1/ 0	9.00							
TRIB	8	...	THOMES CR. EC	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	350.00	79/11/ 1/ 0	350.00												
TRIB	8	...	THOMES CR. ALKALINITY	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	350.00	79/11/ 1/ 0	350.00												
TRIB	8	...	THOMES CR. BOD	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	10.00	79/ 6/ 2/ 0	20.00	79/10/ 2/ 0	20.00	79/10/ 2/ 0	20.00	79/11/ 1/ 0	10.00						
TRIB	8	...	THOMES CR. NH ₃	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	0.05	79/11/ 1/ 0	0.05												
TRIB	8	...	THOMES CR. DO	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	135.00	79/11/ 1/ 0	135.00												
TRIB	9	...	INFLOW = TOTAL LOCAL FLOW	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00												
TRIB	9	...	BYPASSED FEATHER RIVER	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	13.90	79/ 4/19/ 0	14.40	79/ 5/17/ 0	14.40	79/ 5/17/ 0	17.80	79/ 7/19/ 0	15.60	79/ 8/16/ 0	15.60	79/ 9/20/ 0	15.60	79/ 9/20/ 0	12.20
TRIB	9	...	BYPASSED FEATHER RIVER EC	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME
	79/ 4/ 2/ 0	68.00	79/ 4/19/ 0	68.00	79/ 5/17/ 0	68.00	79/ 5/17/ 0	64.00	79/ 7/19/ 0	65.00	79/ 8/16/ 0	65.00	79/ 9/20/ 0	65.00	79/ 9/20/ 0	51.00

TRIB 9 ... BYPASSED FEATHER RIVER ALKALINITY		TOTAL ALKALINITY		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	40.00	79/11/ 1/ 0	50.00														
TRIB 9 ... BYPASSED FEATHER RIVER BOD		CARBONACEOUS BOD		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	0.50	79/11/ 1/ 0	0.50														
TRIB 9 ... BYPASSED FEATHER RIVER AMMONIA		AMMONIA AS N		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	0.03	79/ 5/17/ 0	0.01	79/ 7/19/ 0	0.00	79/11/ 1/ 0	0.00										
TRIB 9 ... BYPASSED FEATHER RIVER DISSOLVED OXYGEN/ISOLVED OXYGEN, MG/L		TIME		VALUE		TIME		VALUE		TIME		VALUE		TIME		VALUE	
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	10.00	79/ 4/19/ 0	10.00	79/ 5/17/ 0	9.20	79/ 7/19/ 0	8.60	79/ 8/16/ 0	7.60	79/ 9/20/ 0	6.20						
TRIB 10 ... INFLOW = TOTAL LOCAL FLOW		INFLOW RATE AS FRACTION OF LOCAL FLOW		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00														
TRIB 10 ... YUBA RIVER		TEMPERATURE, C		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	11.00	79/ 4/25/ 0	13.50	79/ 5/25/ 0	15.50	79/ 6/22/ 0	15.50										
79/ 9/21/ 0	15.50	79/11/ 1/ 0	15.50														
TRIB 10 ... YUBA RIVER EC		SPECIFIC CONDUCTANCE		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	87.00	79/ 4/25/ 0	92.00	79/ 5/24/ 0	72.00	79/ 6/22/ 0	72.00										
79/ 9/21/ 0	76.00	79/11/ 1/ 0	76.00														
TRIB 10 ... YUBA RIVER ALKALINITY		TOTAL ALKALINITY		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	34.00	79/ 4/25/ 0	36.00	79/ 5/24/ 0	29.00	79/ 6/22/ 0	31.00										
79/ 9/21/ 0	32.00	79/11/ 1/ 0	32.00														
TRIB 10 ... YUBA RIVER BOD		CARBONACEOUS BOD		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	10.00	79/11/ 1/ 0	10.00														
TRIB 10 ... YUBA RIVER AMMONIA		AMMONIA AS N		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	0.01	79/ 4/25/ 0	0.00	79/ 5/24/ 0	0.02	79/ 6/22/ 0	0.00										
79/ 9/22/ 0	0.00	79/11/ 1/ 0	0.00														
TRIB 10 ... YUBA RIVER DO		DISSOLVED OXYGEN, MG/L		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	11.00	79/ 4/25/ 0	10.80	79/ 5/24/ 0	10.00	79/ 6/22/ 0	9.50										
79/ 9/21/ 0	10.30	79/11/ 1/ 0	10.30														
TRIB 11 ... INFLOW = TOTAL LOCAL FLOW		INFLOW RATE AS FRACTION OF LOCAL FLOW		TIME		VALUE		TIME		VALUE		TIME		VALUE			
TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE		
79/ 4/ 2/ 0	-1.00	79/11/ 1/ 0	-1.00														

***** CALIBRATION MODE ***** GATE SPECIFICATIONS *****

START TIME (YR/MDA) 790401 END TIME (YR/MDA) 791031

RES I.D.	START TIME	END TIME	SPILLWAY	FLOOD CONTROL	WET WELL 1 FLOW GATE CFS NO	WET WELL 2 FLOW GATE CFS NO
1	790401	791031	0.00	0.00	1.00 1.	0.00 0.
3	790401	791031	0.00	0.00	1.00 1.	0.00 0.
13	790401	791031	0.00	0.00	1.00 4.	1.00 4.
20	790401	791031	0.00	0.00	1.00 1.	0.00 0.

*RTCOF

ROUTING COEFFICIENTS FROM RES 1 TO MY

MY= 2 1.0000						
MY= 3 1.0000						
MY= 4 0.2857 0.5102 0.1458 0.0416 0.0119 0.0034						
MY= 5 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020						
MY= 6 0.0816 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020						
MY= 7 0.0233 0.1249 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014						
MY= 8 0.0067 0.0476 0.1411 0.2285 0.2302 0.1640 0.0950 0.0478 0.0212 0.0083						
MY= 9 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269						
MY= 10 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269						
MY= 11 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269						
MY= 12 0.0019 0.0170 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269						
MY= 19 0.0005 0.0058 0.0277 0.0773 0.1426 0.1889 0.1854 0.1479 0.1081 0.0595						
MY= 20 0.0317 0.0153 0.0068 0.0028 0.0010						
MY= 22 0.0002 0.0019 0.0110 0.0371 0.0845 0.1386 0.1727 0.1710 0.1408 0.1001						
MY= 23 0.0630 0.0358 0.0185 0.0088 0.0039 0.0016						
MY= 24 0.0000 0.0068 0.0041 0.0165 0.0447 0.0886 0.1341 0.1612 0.1596 0.1345						
MY= 25 0.0993 0.0655 0.0392 0.0215 0.0109 0.0052 0.0023						

ROUTING COEFFICIENTS FROM RES

13 TO MY

NY=	14	1.0000
NY=	15	0.2857
NY=	16	0.2857
NY=	17	0.0816
NY=	18	0.0233
NY=	19	0.0067
NY=	20	0.0029
NY=	21	0.0019
NY=	22	0.0005
NY=	23	0.0317

0.5102 0.1458 0.0416 0.0119 0.0034
 0.5102 0.1458 0.0416 0.0119 0.0034
 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014
 0.2285 0.2302 0.1640 0.0950 0.0478 0.0212 0.0083
 0.0656 0.1445 0.2050 0.2041 0.1557 0.0988 0.0546 0.0269
 0.0048 0.0017 0.0119 0.0119 0.0119 0.0119 0.0119 0.0119
 0.0277 0.0773 0.1426 0.1869 0.1854 0.1479 0.1001 0.0595
 0.0058 0.0153 0.0068 0.0028 0.0010

ROUTING COEFFICIENTS FROM RES

20 TO MY

NY=	21	0.2857
NY=	22	0.0816
NY=	23	0.0233

0.5102 0.1458 0.0416 0.0119 0.0034
 0.2915 0.3436 0.1725 0.0705 0.0262 0.0087 0.0020
 0.2588 0.2705 0.1714 0.0867 0.0384 0.0150 0.0049 0.0014

INTERPOLATION OF RESERVOIR LEVELS (RL CARDS) WAS USED.

RESERVOIR MODEL RESULTS

RESERVOIR NO 1 .. CONTROL POINT 1

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA

EQUILIBRIUM TEMPERATURE, C	17.3
HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
WIND SPEED, M/S	4.5
EVAPORATION RATE, AC. FT./DAY	6.86

EQUILIBRIUM TEMPERATURE, C
HEAT EXCHANGE COEFFICIENT, LANGLAYS/C
SHORT WAVE SOLAR RADIATION, LANGLAYS
WIND SPEED, M/S
EVAPORATION RATE, AC. FT./DAY

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
1	8839.8	3.2	120.0	55.00	0.00	0.00	0.96	0.00	13.4

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	6232.9	5.9	129.0	45.96	0.00	0.00	0.08	0.00	5.6
TOTAL OUTFLOW	6232.9	5.9	129.0	45.95	0.00	0.00	0.08	0.00	5.6

RESERVOIR INFORMATION

WATER SURFACE ELEVATION, FT	1048.27
RESERVOIR SURFACE AREA, AC	28161.
RESERVOIR STORAGE VOLUME, ACFT	4270990.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
5.0	17.1	131.6	46.14	0.00	0.00	0.03	0.00	9.4
15.0	13.3	129.8	45.57	0.00	0.00	0.03	0.00	7.4
25.0	9.2	129.3	45.77	0.00	0.00	0.05	0.00	5.8
35.0	8.0	128.6	46.45	0.00	0.00	0.09	0.00	6.1
45.0	7.4	128.4	46.64	0.00	0.00	0.09	0.00	6.2
55.0	7.3	128.4	46.56	0.00	0.00	0.09	0.00	6.1
65.0	7.2	128.6	46.44	0.00	0.00	0.08	0.00	6.0
75.0	7.2	128.7	46.31	0.00	0.00	0.07	0.00	5.9
85.0	7.1	128.8	46.20	0.00	0.00	0.07	0.00	5.8
95.0	7.1	128.9	46.11	0.00	0.00	0.06	0.00	5.8
105.0	7.0	129.0	46.03	0.00	0.00	0.06	0.00	5.7
115.0	6.8	129.0	45.99	0.00	0.00	0.06	0.00	5.7
125.0	6.7	129.0	46.00	0.00	0.00	0.07	0.00	5.7
135.0	6.5	129.0	46.04	0.00	0.00	0.07	0.00	5.7
145.0	6.4	128.9	46.14	0.00	0.00	0.08	0.00	5.8

155.0	6.3	128.8	46.19	0.00	0.00
165.0	6.2	128.8	46.21	0.00	0.00
175.0	6.1	128.8	46.20	0.00	0.00
185.0	6.0	128.8	46.18	0.00	0.00
195.0	5.9	128.8	46.15	0.00	0.00
205.0	5.9	128.9	46.12	0.00	0.00
215.0	5.8	128.9	46.08	0.00	0.00
225.0	5.7	129.0	46.02	0.00	0.00
235.0	5.7	129.1	45.90	0.00	0.00
245.0	5.7	129.2	45.80	0.00	0.00
255.0	5.6	129.3	45.73	0.00	0.00
265.0	5.6	129.3	45.68	0.00	0.00
275.0	5.6	129.4	45.64	0.00	0.00
285.0	5.6	129.4	45.61	0.00	0.00
295.0	5.6	129.4	45.57	0.00	0.00
305.0	5.6	129.5	45.54	0.00	0.00
315.0	5.6	129.5	45.51	0.00	0.00
325.0	5.6	129.5	45.48	0.00	0.00
335.0	5.6	129.5	45.46	0.00	0.00
345.0	5.6	129.6	45.45	0.00	0.00
355.0	5.6	129.6	45.43	0.00	0.00
365.0	5.6	129.6	45.42	0.00	0.00
375.0	5.6	129.6	45.41	0.00	0.00
385.0	5.6	129.6	45.39	0.00	0.00
395.0	5.6	129.6	45.37	0.00	0.00
405.0	5.6	129.7	45.32	0.00	0.00
415.0	5.7	129.8	45.20	0.00	0.00

RESERVOIR MODEL RESULTS

RESERVOIR NO 2 .. CONTROL POINT 3

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA

EQUILIBRIUM TEMPERATURE, C 17.3
 HEAT EXCHANGE COEFFICIENT, LANGLAWS/C 62.7
 SHORT WAVE SOLAR RADIATION, LANGLAWS 512.
 WIND SPEED, M/S 4.5
 EVAPORATION RATE, AC.FT./DAY 0.07

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
50	6717.9	6.6	134.2	46.60	0.00	0.00	0.07	0.00	6.4

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	6717.8	6.9	132.2	46.18	0.00	0.00	0.06	0.00	6.2
TOTAL OUTFLOW	6717.8	6.9	132.2	46.18	0.00	0.00	0.06	0.00	6.2

RESERVOIR INFORMATION WATER SURFACE ELEVATION, FT 569.70
 RESERVOIR SURFACE AREA, AC 285.
 RESERVOIR STORAGE VOLUME, ACFT 22000.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
5.0	8.3	134.4	46.57	0.00	0.00	0.06	0.00	6.8
15.0	7.4	134.4	46.57	0.00	0.00	0.06	0.00	6.5
25.0	7.1	134.4	46.57	0.00	0.00	0.06	0.00	6.5
35.0	7.0	134.6	46.59	0.00	0.00	0.06	0.00	6.4
45.0	6.9	134.5	46.58	0.00	0.00	0.06	0.00	6.4
55.0 ¹	6.9	134.0	46.50	0.00	0.00	0.06	0.00	6.4
65.0	6.9	133.2	46.38	0.00	0.00	0.06	0.00	6.3
75.0	6.8	132.5	46.27	0.00	0.00	0.06	0.00	6.2
85.0	6.6	131.3	46.08	0.00	0.00	0.06	0.00	6.0
95.0	6.4	130.3	45.88	0.00	0.00	0.06	0.00	5.9
105.0	6.2	129.1	45.55	0.00	0.00	0.06	0.00	5.7
115.0	6.1	127.1	44.75	0.00	0.00	0.05	0.00	5.6
125.0	5.9	123.9	43.38	0.00	0.00	0.04	0.00	5.4

RESERVOIR MODEL RESULTS

RESERVOIR NO 3 .. CONTROL POINT 13

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA	EQUILIBRIUM TEMPERATURE, C	17.3
	HEAT EXCHANGE COEFFICIENT, LANGLAYS/C	62.7
	SHORT WAVE SOLAR RADIATION, LANGLAYS	512.
	WIND SPEED, M/S	4.5
	EVAPORATION RATE, AC. FT./DAY	14.87

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
1	7803.9	13.2	61.5	150.00	0.00	3.42	0.00	9.9	
2									
TOTAL	3561.9	13.8	61.9	80.53	0.00	0.00	0.63	0.00	8.5

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
WET WELL NO 1	1781.0	12.9	61.9	82.36	0.00	0.00	0.63	0.00	8.3
WET WELL NO 2	1781.0	14.6	61.9	78.71	0.00	0.00	0.51	0.00	8.6
TOTAL OUT FLOW	3561.9	13.8	61.9	80.53	0.00	0.00	0.63	0.00	8.5

RESERVOIR INFORMATION	WATER SURFACE ELEVATION, FT	884.25
	RESERVOIR SURFACE AREA, AC	15389.
	RESERVOIR STORAGE VOLUME, ACFT	3297820.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
7.002	16.1	62.0	70.43	0.00	0.00	0.28	0.00	9.0
21.0	13.9	61.9	89.64	0.00	0.00	0.76	0.00	8.3
35.0	12.6	61.9	87.82	0.00	0.00	0.78	0.00	8.2
49.0	12.2	61.9	81.14	0.00	0.00	0.70	0.00	8.3
63.0	11.7	62.0	51.60	0.00	0.00	0.12	0.00	8.3
77.0	11.5	62.0	46.36	0.00	0.00	0.05	0.00	8.3
91.0	11.4	62.0	43.81	0.00	0.00	0.02	0.00	8.2
105.0	11.0	62.0	41.59	0.00	0.00	0.01	0.00	7.8
119.0	10.2	62.0	40.32	0.00	0.00	0.00	0.00	7.3
133.0	9.4	62.0	40.05	0.00	0.00	0.00	0.00	6.9
147.0	8.9	62.0	40.01	0.00	0.00	0.00	0.00	6.6
161.0	8.4	62.0	40.00	0.00	0.00	0.00	0.00	6.3
175.0	8.0	62.0	40.00	0.00	0.00	0.00	0.00	6.0
189.0	7.6	62.0	40.00	0.00	0.00	0.00	0.00	5.8
203.0	7.3	62.0	40.00	0.00	0.00	0.00	0.00	5.4

RESERVOIR MODEL RESULTS

RESERVOIR NO 4 .. CONTROL POINT 20

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA

EQUILIBRIUM TEMPERATURE, C 17.3
 HEAT EXCHANGE COEFFICIENT, LANGLAYS/C 62.7
 SHORT WAVE SOLAR RADIATION, LANGLAYS 512.
 WIND SPEED, M/S 4.5
 EVAPORATION RATE, AC.FT./DAY 77.29

INFLOW DATA

TRIB NO	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
3	6279.9	10.9	72.1	16.67	0.00	0.00	3.42	0.01	9.9

OUTFLOW INFORMATION

OUTLET	FLOW CFS	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
WET WELL NO 1	2448.0	9.2	71.5	19.50	0.00	0.00	0.55	0.01	9.1
TOTAL OUTFLOW	2448.0	9.2	71.5	19.50	0.00	0.00	0.55	0.01	9.1

RESERVOIR INFORMATION WATER SURFACE ELEVATION, FT 461.82
 RESERVOIR SURFACE AREA, AC 11157.
 RESERVOIR STORAGE VOLUME, ACFT 263553.

RESERVOIR WATER QUALITY

DEPTH FT	TEMP C	CONS.1 MG/L	CONS.2 MG/L	CONS.3 MG/L	NONCON.1 MG/L	NONCON.2 MG/L	NONCON.3 MG/L	OXYGEN MG/L
3.5	16.3	70.5	20.15	0.00	0.00	0.00	0.01	10.4
4.5	16.3	70.5	20.15	0.00	0.00	0.00	0.01	10.4
17.5	15.7	70.4	20.10	0.30	0.00	0.00	0.01	10.7
24.5	14.1	70.2	20.03	0.00	0.00	0.02	0.01	10.9
31.5	13.0	70.2	19.96	0.00	0.00	0.06	0.01	10.9
38.5	12.1	70.3	19.82	0.00	0.00	0.18	0.01	10.8
45.5	11.5	70.6	19.49	0.00	0.00	0.48	0.01	10.5
52.5	11.0	71.0	18.91	0.00	0.00	1.03	0.01	10.1
59.5	10.7	71.2	18.70	0.00	0.00	1.21	0.01	9.8
66.5	10.6	71.3	18.70	0.00	0.00	1.21	0.01	9.8
73.5	10.4	71.3	18.90	0.00	0.00	1.00	0.01	9.7
80.5	10.3	71.3	19.00	0.00	0.00	0.89	0.01	9.6
87.5	10.1	71.3	19.07	0.00	0.00	0.82	0.01	9.5
94.5	10.0	71.4	19.13	0.00	0.00	0.77	0.01	9.4
101.5	9.8	71.4	19.19	0.00	0.00	0.72	0.01	9.3
108.5	9.7	71.4	19.25	0.00	0.00	0.68	0.01	9.3

STREAM MODEL RESULTS

JULIAN DATE 120 (HOUR 24)

METEOROLOGICAL DATA
(MET. ZONE 1)

	EQUILIBRIUM TEMPERATURE, C
1	17.3
3	62.7
13	512.5
20	4.5

HEAT EXCHANGE COEFFICIENT, LANGLAWS/C
SHORT WAVE SOLAR RADIATION, LANGLAWS
WIND SPEED, M/S

RESERVOIR RELEASES

RESERVOIR NO	FLOW CFS	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
1	6232.0	5.9	129.00	45.95	0.00	0.00	0.08	0.00	5.6
3	6717.9	6.9	132.24	46.18	0.00	0.00	0.06	0.00	6.2
13	3562.0	13.8	61.92	80.35	0.00	0.00	0.60	0.00	8.5
20	2448.0	9.2	71.55	19.50	0.00	0.00	1.55	0.01	9.1

LOCAL FLOWS AND WATER QUALITY

C.P. NO	FLOW CFS	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
2	485.0	13.2	200.00	55.00	0.00	0.00	0.00	0.00	13.2
4	610.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
5	897.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
6	510.0	16.7	200.00	100.00	0.00	0.00	0.00	0.00	13.2
8	410.0	23.7	350.00	350.00	0.00	0.00	10.03	0.01	11.6
14	89.0	15.8	66.36	61.34	0.00	0.00	0.34	0.00	9.7
15	400.0	15.8	66.36	41.34	0.00	0.00	0.34	0.00	9.7
17	581.0	13.9	88.21	34.67	0.00	0.00	6.84	0.00	10.6
18	356.0	15.7	87.67	27.62	0.00	0.00	6.84	0.08	9.4

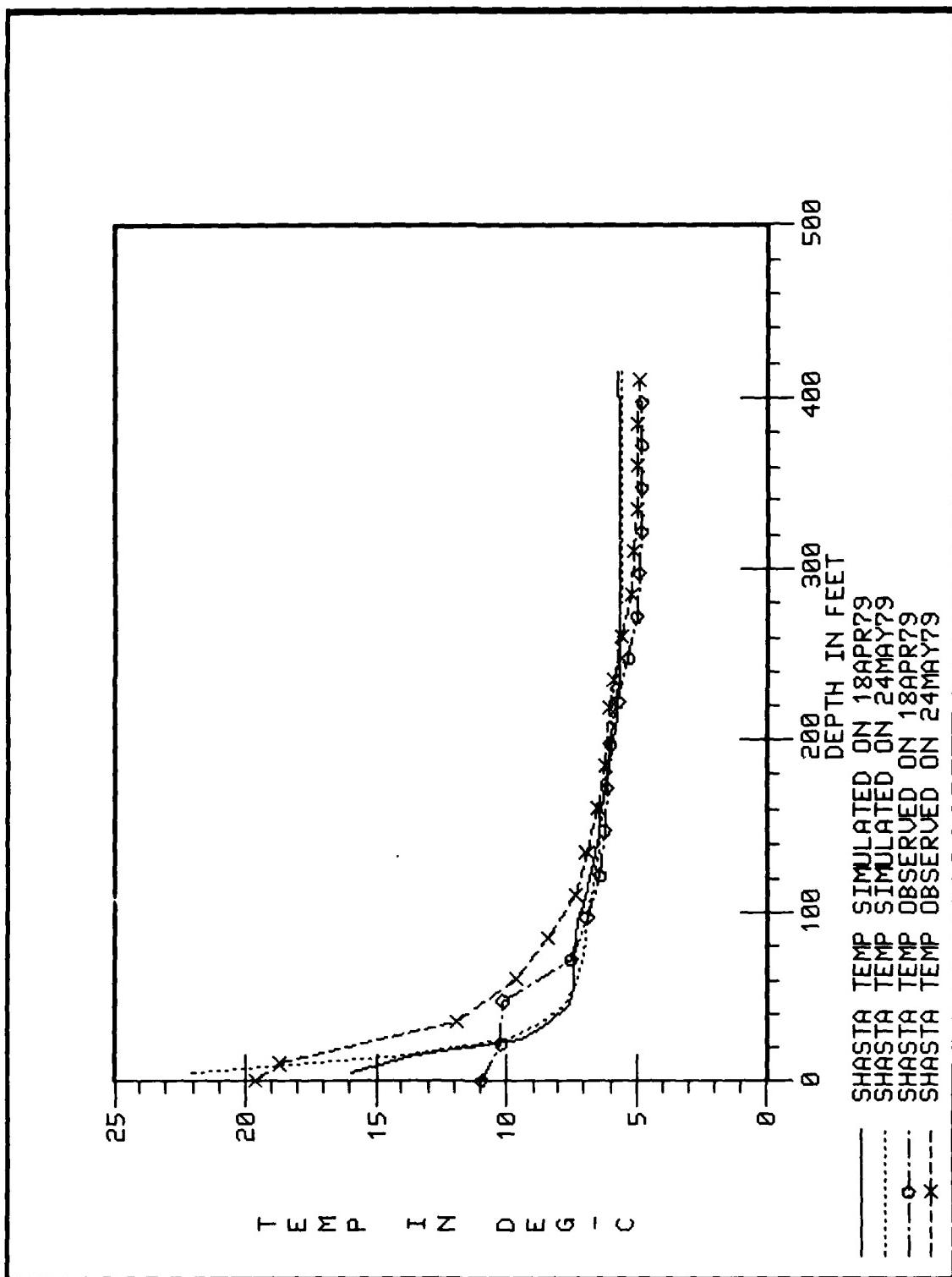
STREAM WATER QUALITY

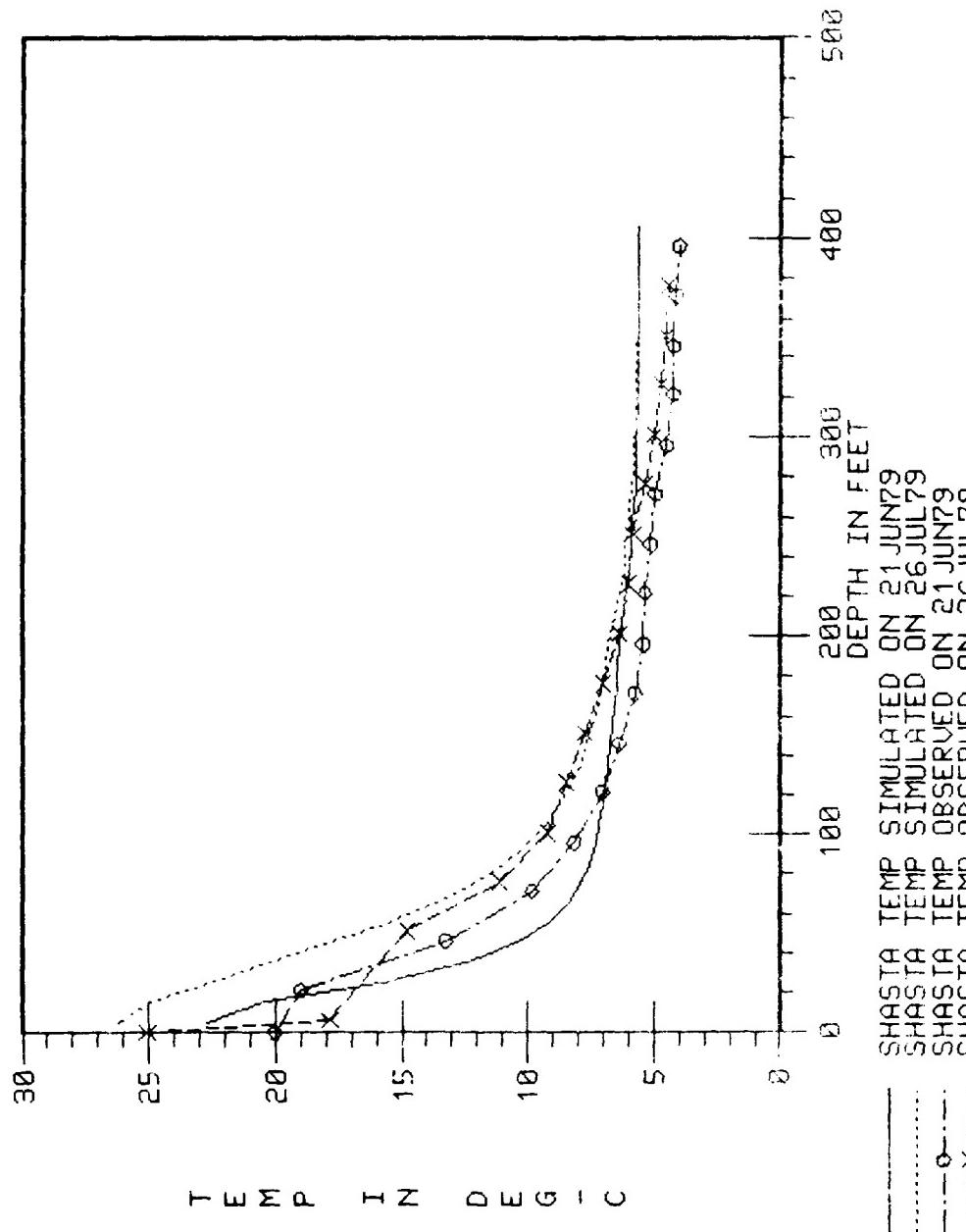
LOCATION	C.P./TRIB	TEMP C	CONS. 1 MG/L	CONS. 2 MG/L	CONS. 3 MG/L	NONCON. 1 MG/L	NONCON. 2 MG/L	NONCON. 3 MG/L	OXYGEN MG/L
302.85	1 / 0	6.0	129.00	45.94	0.00	0.00	0.08	0.00	5.7
300.95	2 / 4	6.6	134.17	46.60	0.00	0.00	0.07	0.00	6.4
292.25	3 / 0	7.2	132.02	46.15	0.00	0.00	0.06	0.00	7.0
287.59		7.5	131.86	46.12	0.00	0.00	0.06	0.00	7.5
282.93		7.7	131.72	46.10	0.00	0.00	0.06	0.00	8.0
278.27	4 / 5	8.8	137.56	50.78	0.00	0.00	0.06	0.00	8.8
274.77	4 / 0	8.9	137.51	50.79	0.00	0.00	0.06	0.00	8.9
272.44	5 / 6	9.9	144.81	56.59	0.00	0.00	0.05	0.00	9.5
268.95	5 / 7	10.4	147.09	58.86	0.00	0.00	0.05	0.00	9.7
264.29	6 / 0	10.6	147.06	58.90	0.00	0.00	0.05	0.00	9.8
259.63	6 / 0	10.4	142.64	57.19	0.00	0.00	0.04	0.00	9.7
254.97		10.6	142.64	57.24	0.00	0.00	0.04	0.00	9.8
250.31		10.8	142.65	57.28	0.00	0.00	0.04	0.00	9.9
245.65	7 / 0	10.9	142.66	57.33	0.00	0.00	0.04	0.00	10.0
240.99	7 / 0	11.1	142.68	57.39	0.00	0.00	0.04	0.00	10.1

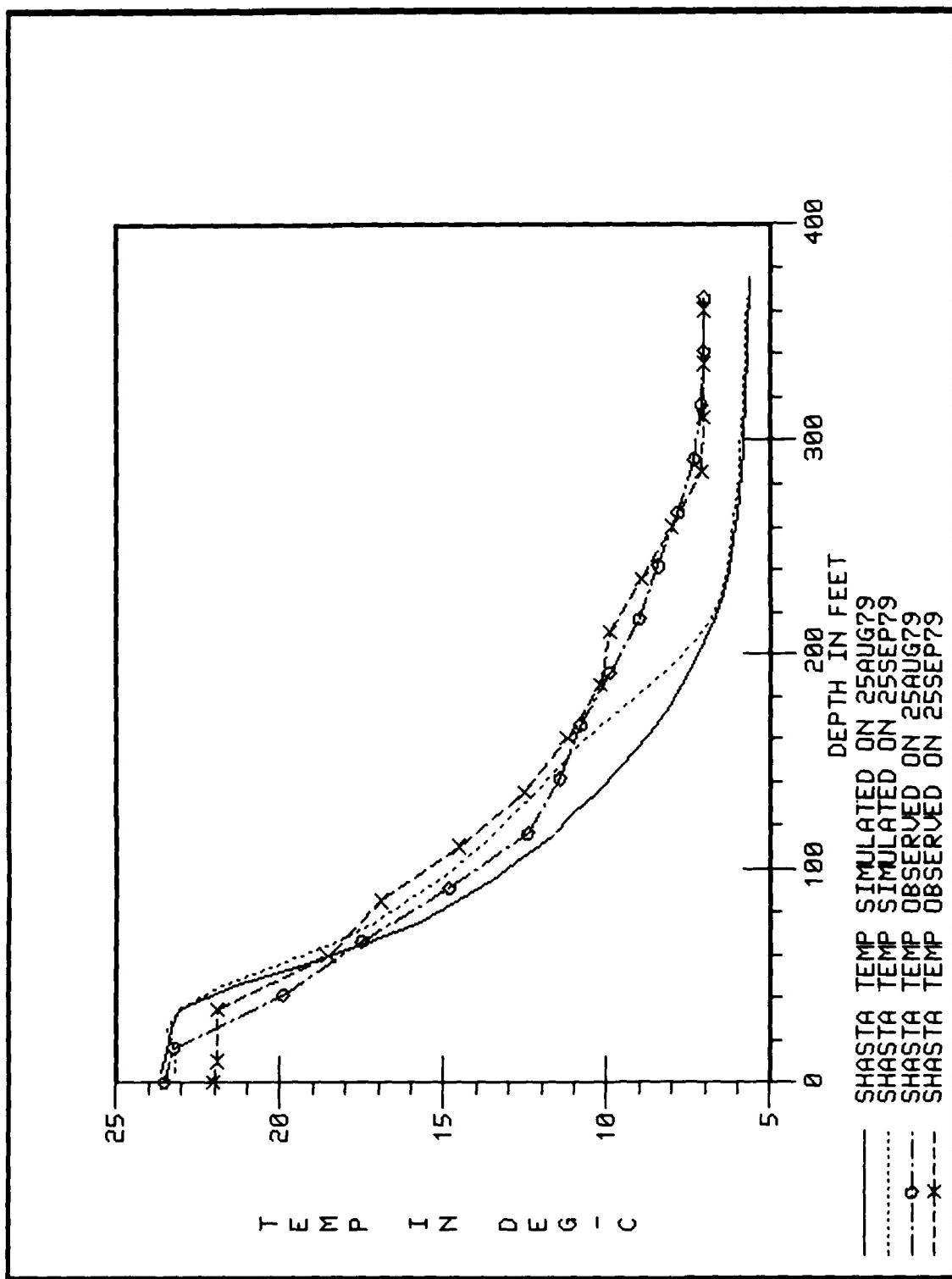
10.95	18 / 11	13.6	51.15	30.20	0.00	2.61	10.0	2722.8
6.57	18 / 0	13.9	51.54	30.32	0.00	2.60	0.00	2796.5
2.19	19 / 0	14.2	52.06	30.44	0.00	2.54	0.00	2833.2
78.16	19 / 0	14.2	59.12	64.45	0.00	1.15	0.00	9737.6
74.05	14.3	59.12	64.15	64.15	0.00	1.14	0.00	9680.0
69.93	14.4	59.12	63.82	63.82	0.00	1.13	0.00	9622.4
65.81	14.5	59.11	63.45	63.45	0.00	1.12	0.00	9564.8
61.70	22 / 0	14.6	59.08	63.05	0.00	1.10	0.00	9507.3
27.26	20 / 0	9.3	71.55	19.50	0.00	0.55	0.01	5.2
24.73	9.5	71.55	19.50	19.50	0.00	0.55	0.00	108.6
22.20	21 / 0	9.9	71.55	19.50	0.00	0.55	0.00	2448.0
18.84	21 / 0	10.4	71.55	19.50	0.00	0.55	0.00	2479.7
14.65	10.8	71.55	19.50	19.50	0.00	0.55	0.00	86.3
10.46	11.3	71.55	19.51	19.51	0.00	0.55	0.00	2513.0
6.28	11.7	71.55	19.51	19.51	0.00	0.54	0.00	35.7
2.09	22 / 0	12.1	71.55	19.51	0.00	0.54	0.00	2498.0
58.31	22 / 0	10.2	71.55	19.50	0.00	0.55	0.00	2432.9
55.64	10.2	71.55	19.51	19.51	0.00	0.55	0.00	12.2
52.97	10.3	71.55	19.51	19.51	0.00	0.55	0.00	0.0
50.30	10.4	71.55	19.51	19.51	0.00	0.54	0.00	1.35
47.63	10.5	71.55	19.51	19.51	0.00	0.54	0.00	0.0
44.96	10.6	71.55	19.51	19.51	0.00	0.54	0.00	1.48
42.29	10.7	71.55	19.51	19.51	0.00	0.54	0.00	1.61
39.62	23 / 0	10.8	71.55	19.51	0.00	0.54	0.00	1.73
						0.00	10.4	11436.1
						0.00	10.4	11355.9
						0.00	0.0	0.0

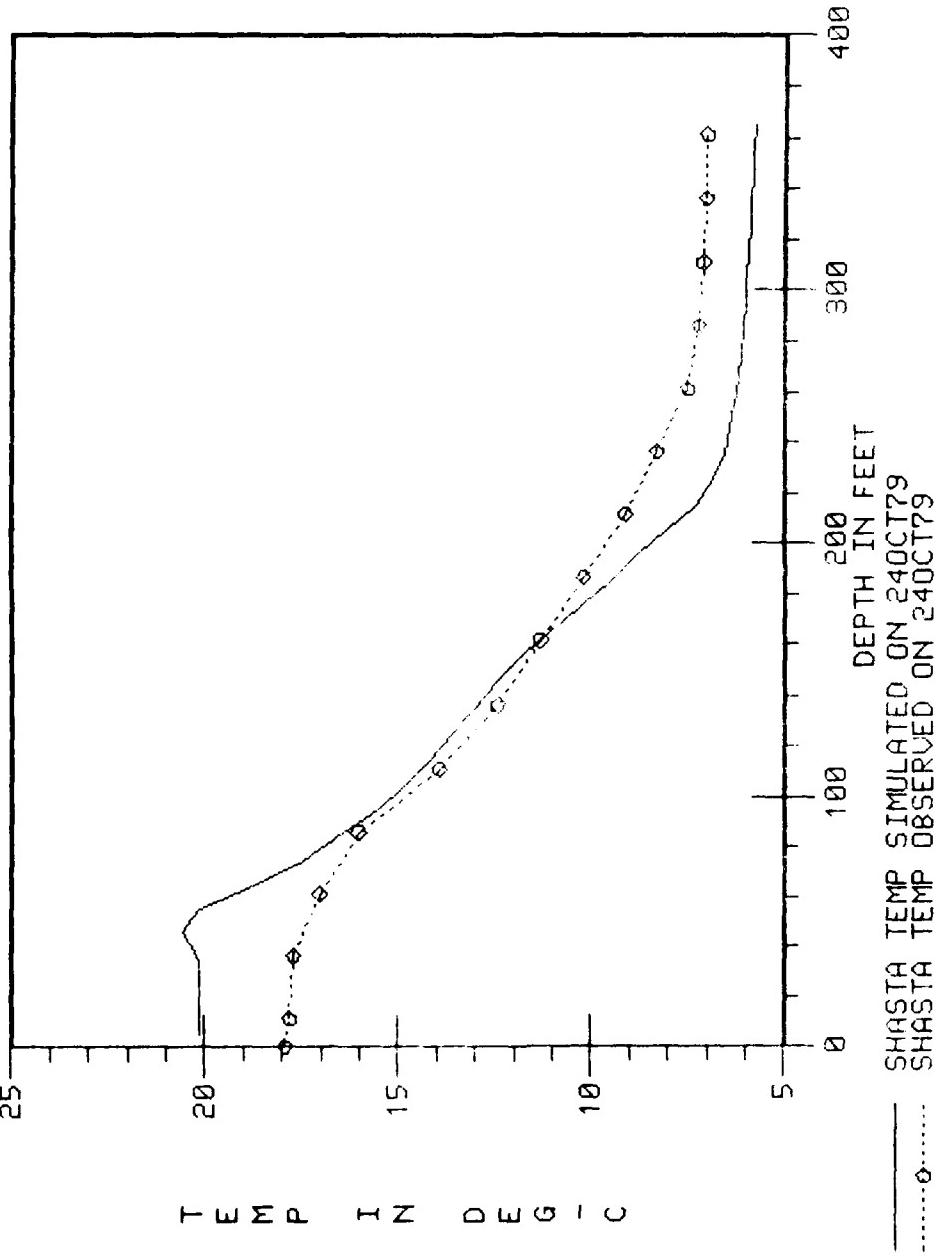
APPENDIX C

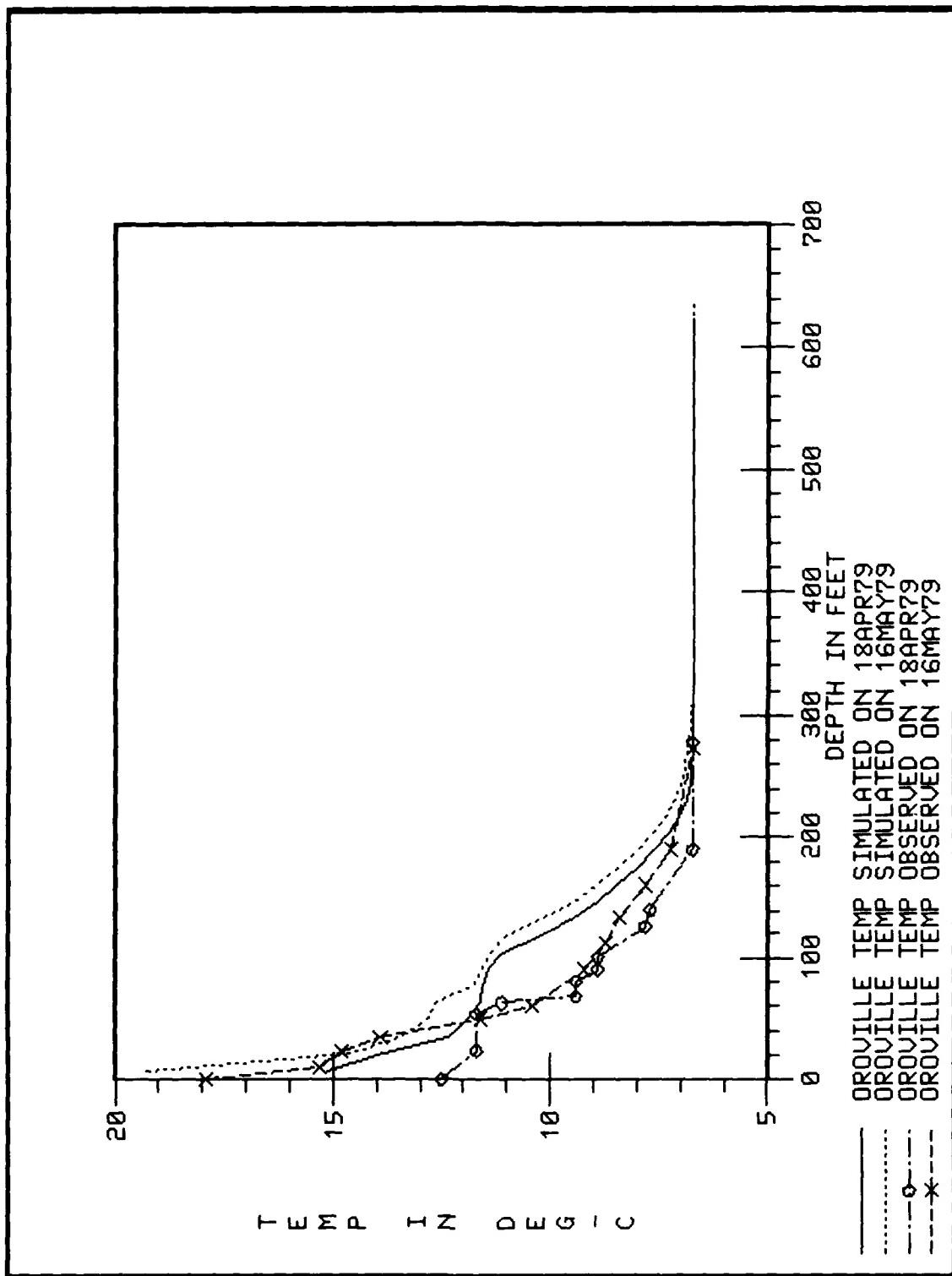
**Graphical Displays of Sacramento River System
Water Quality Modeling**

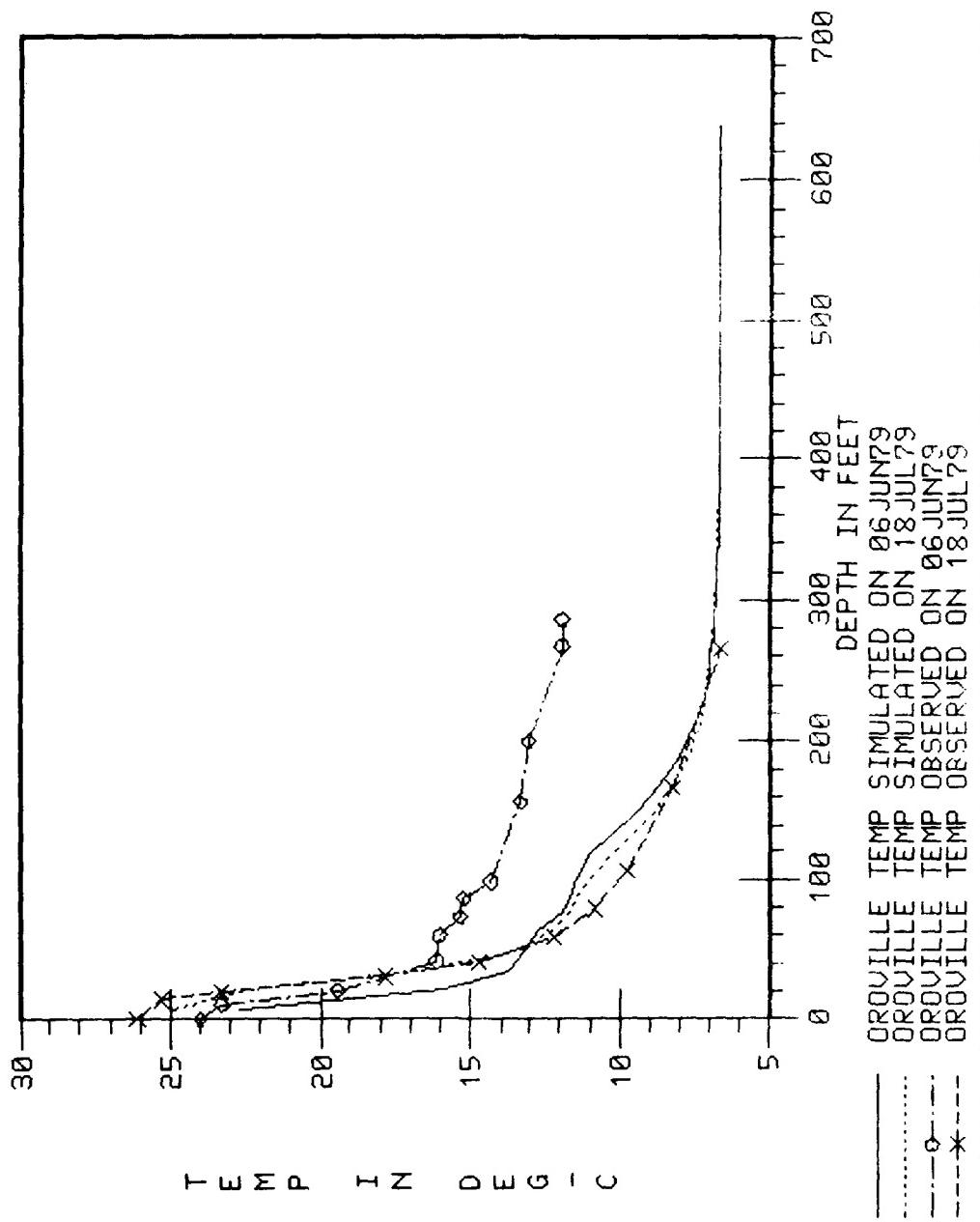


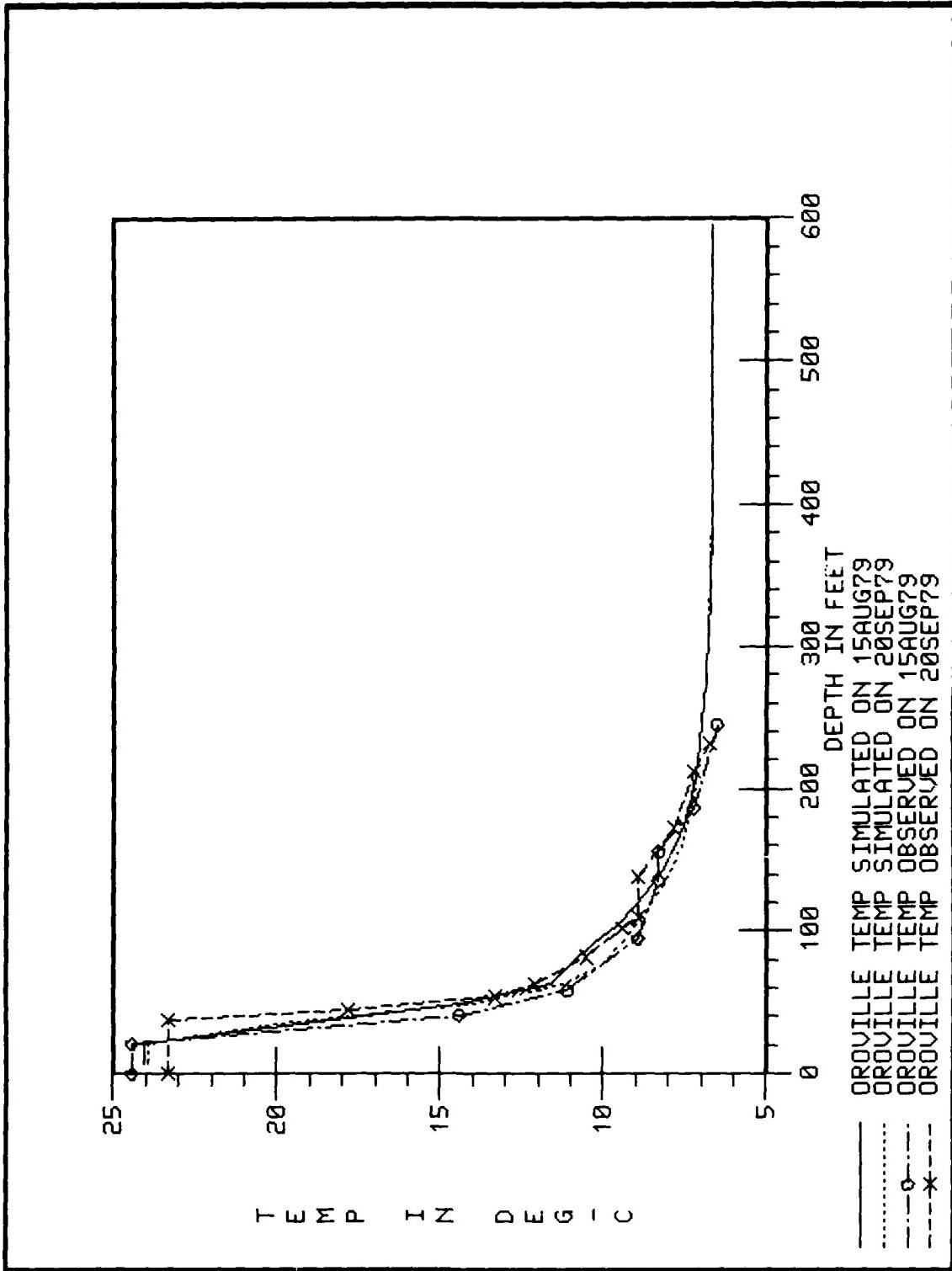


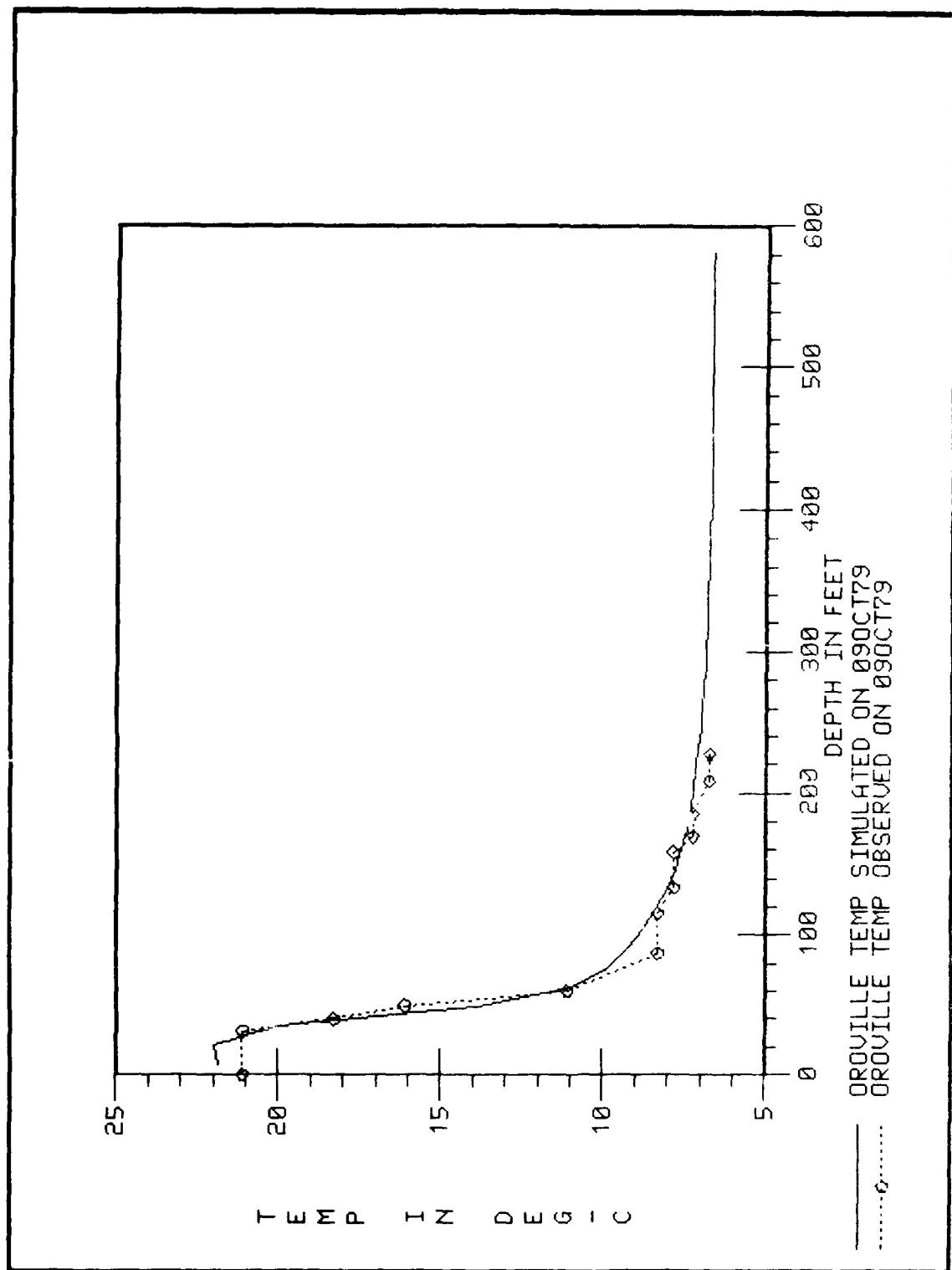


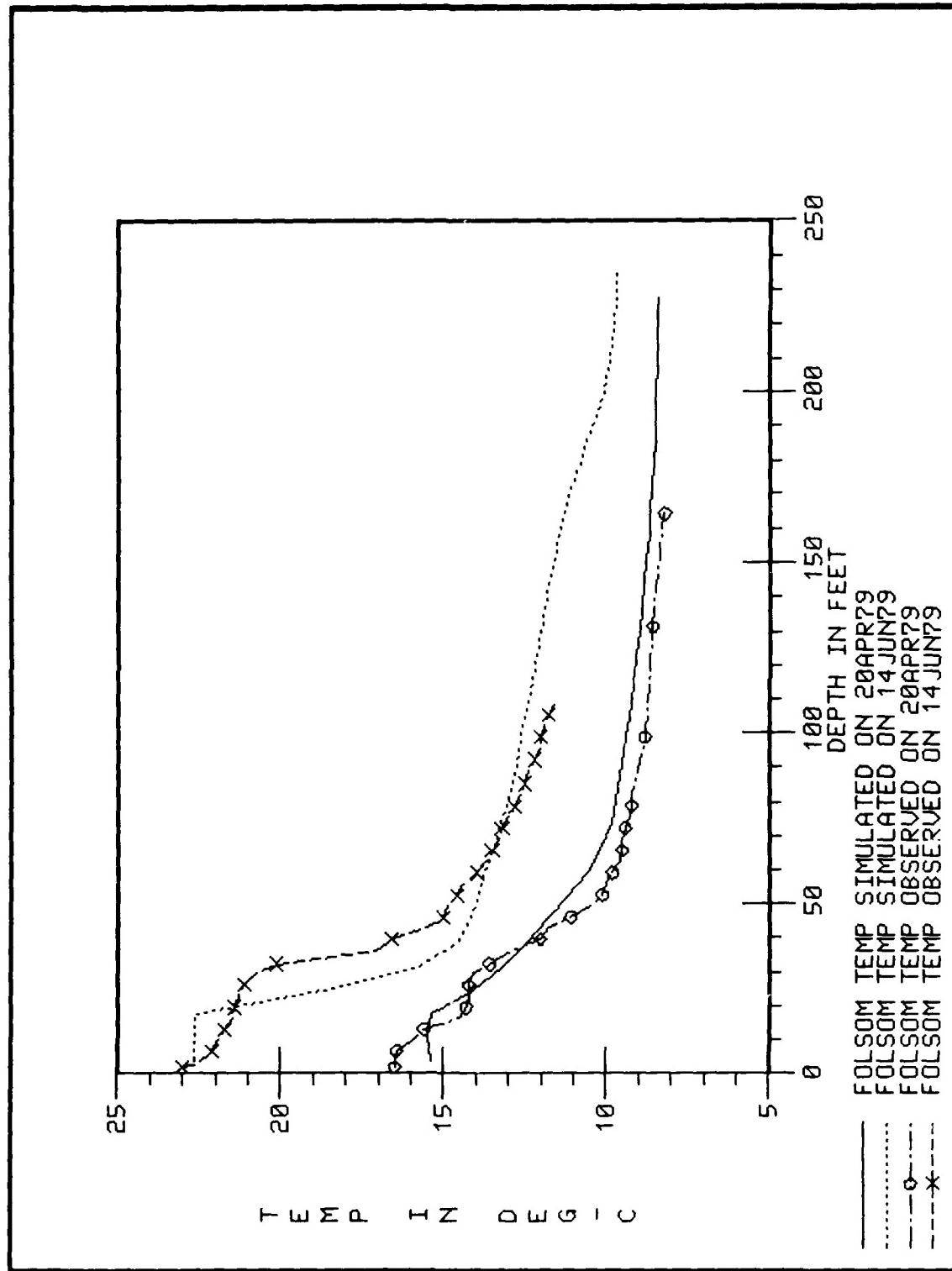


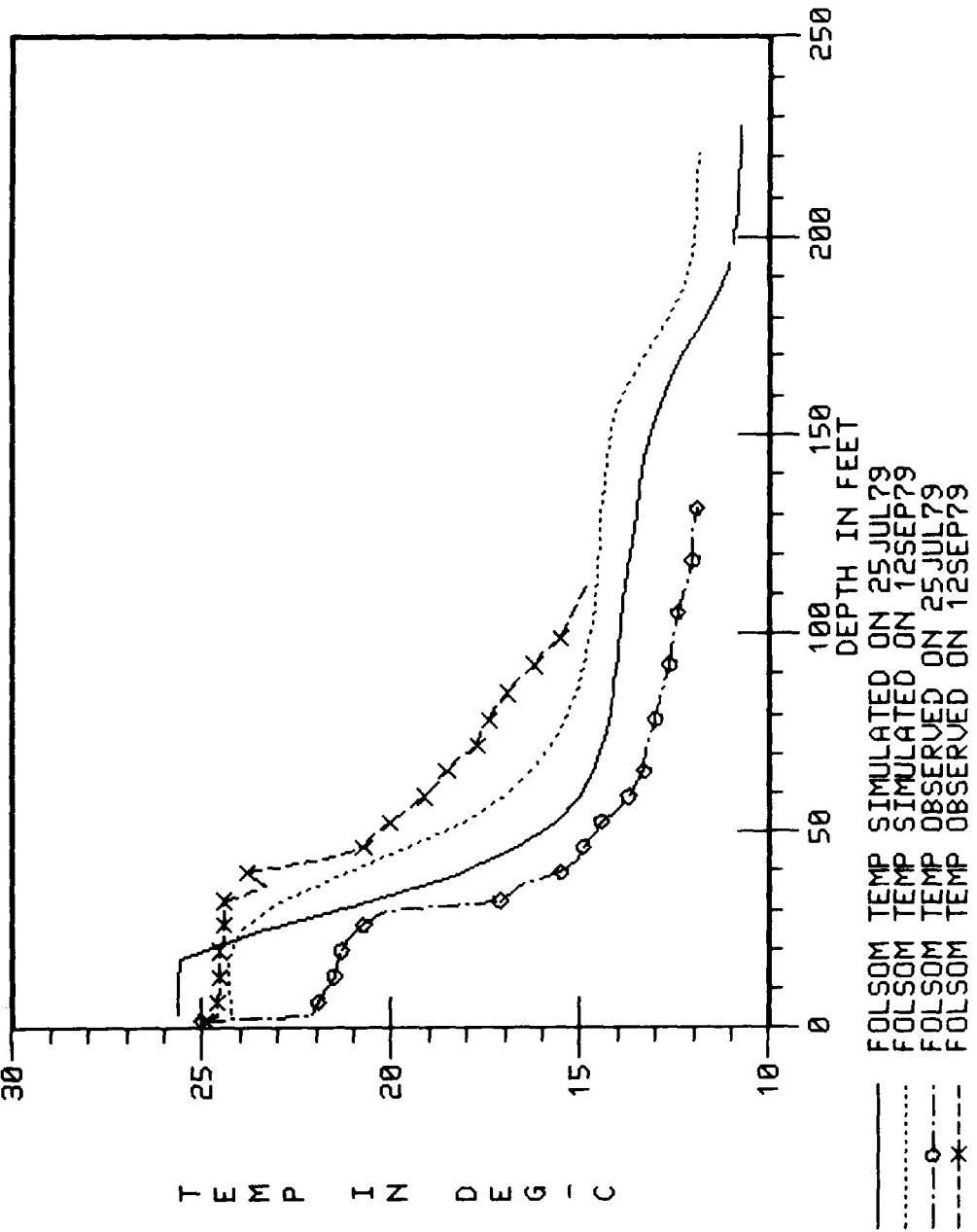


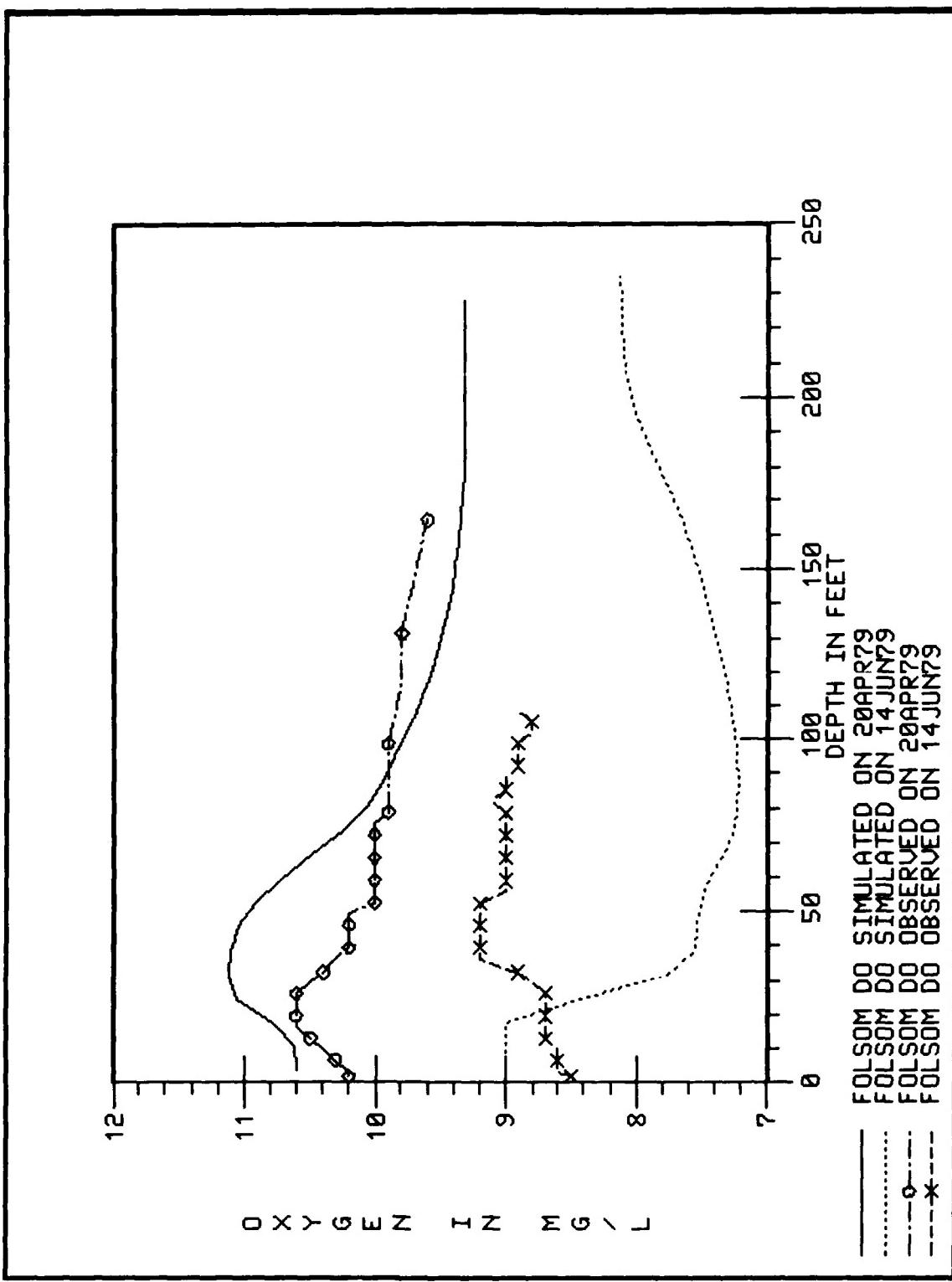


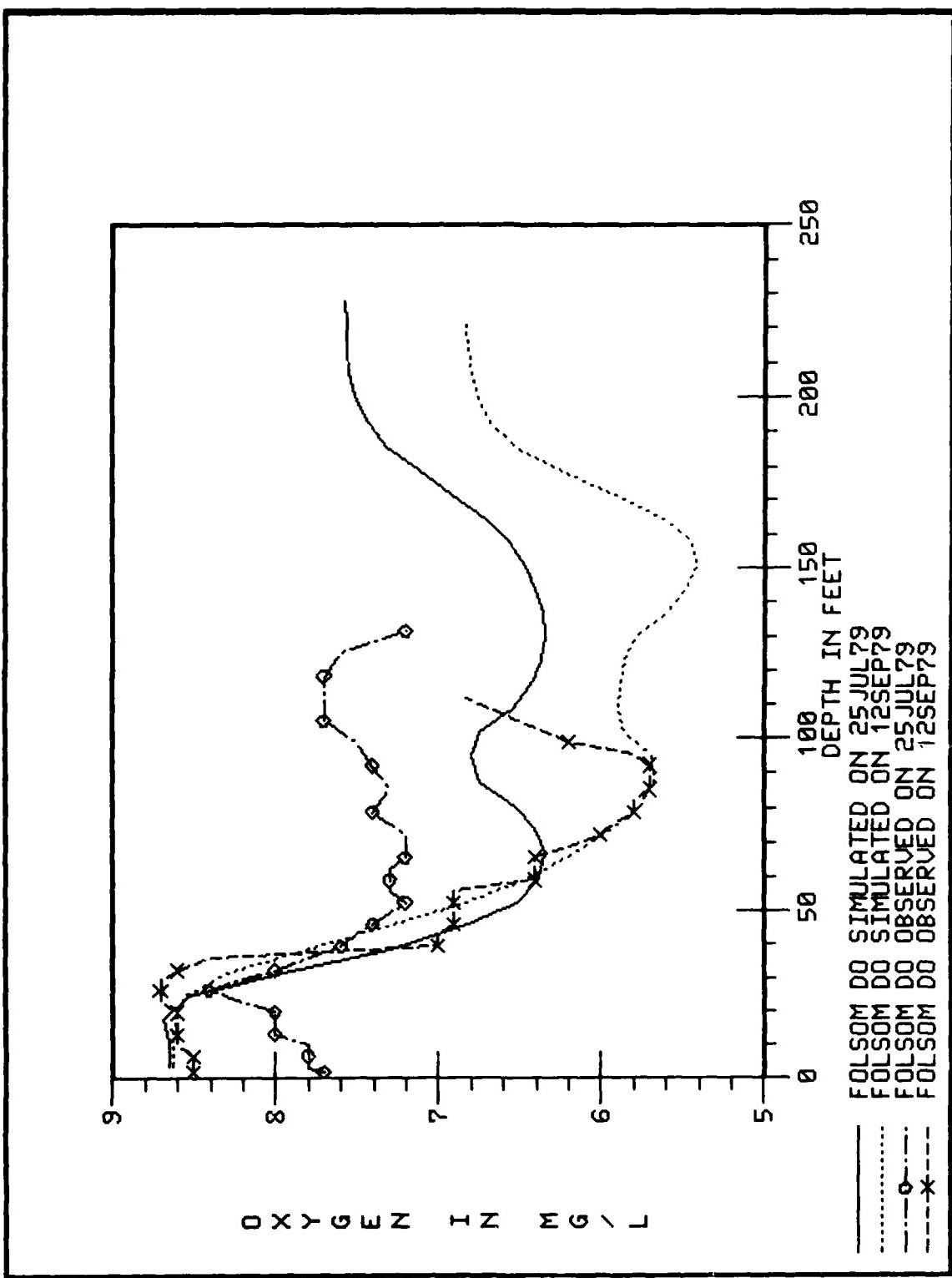


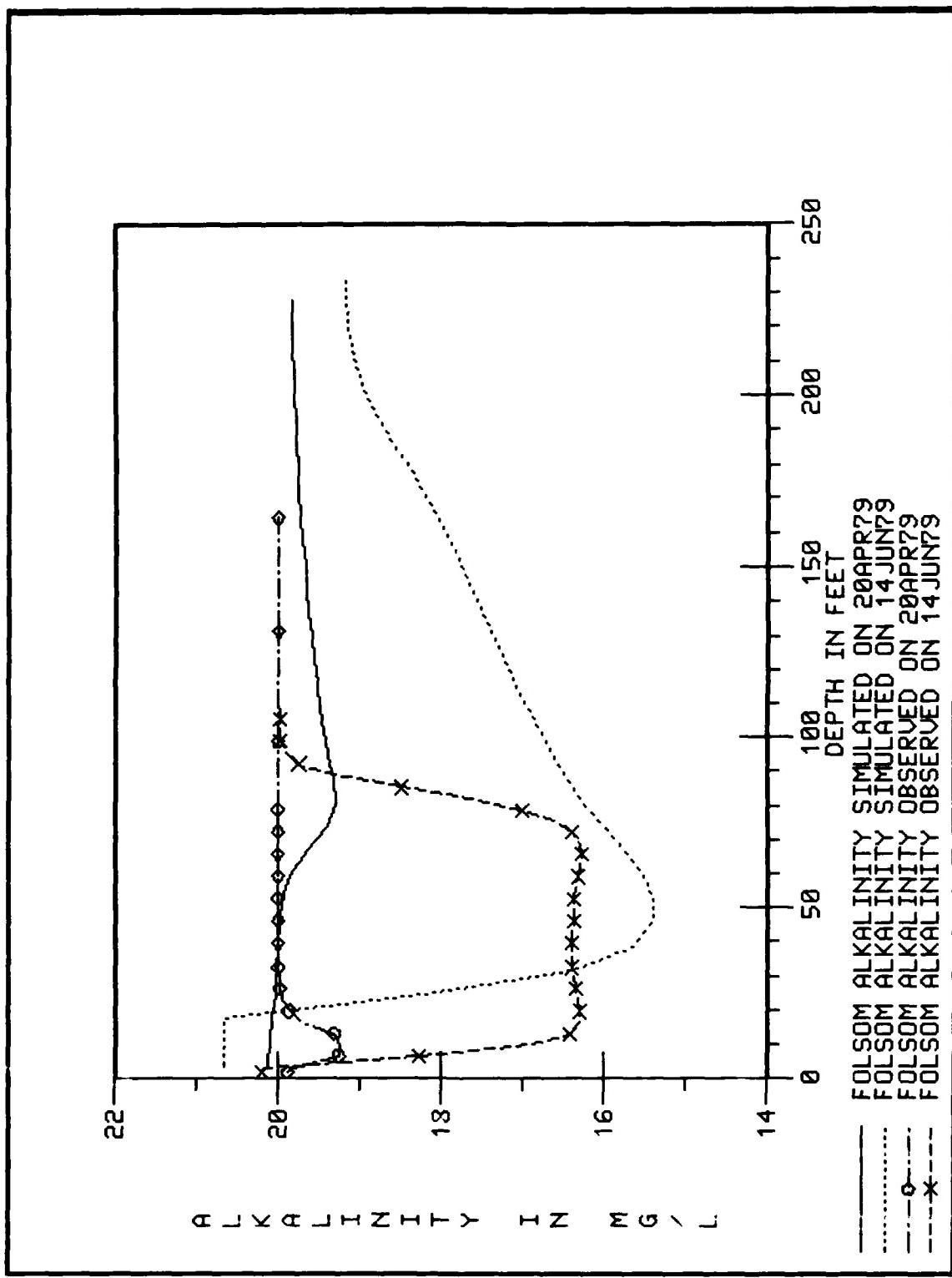


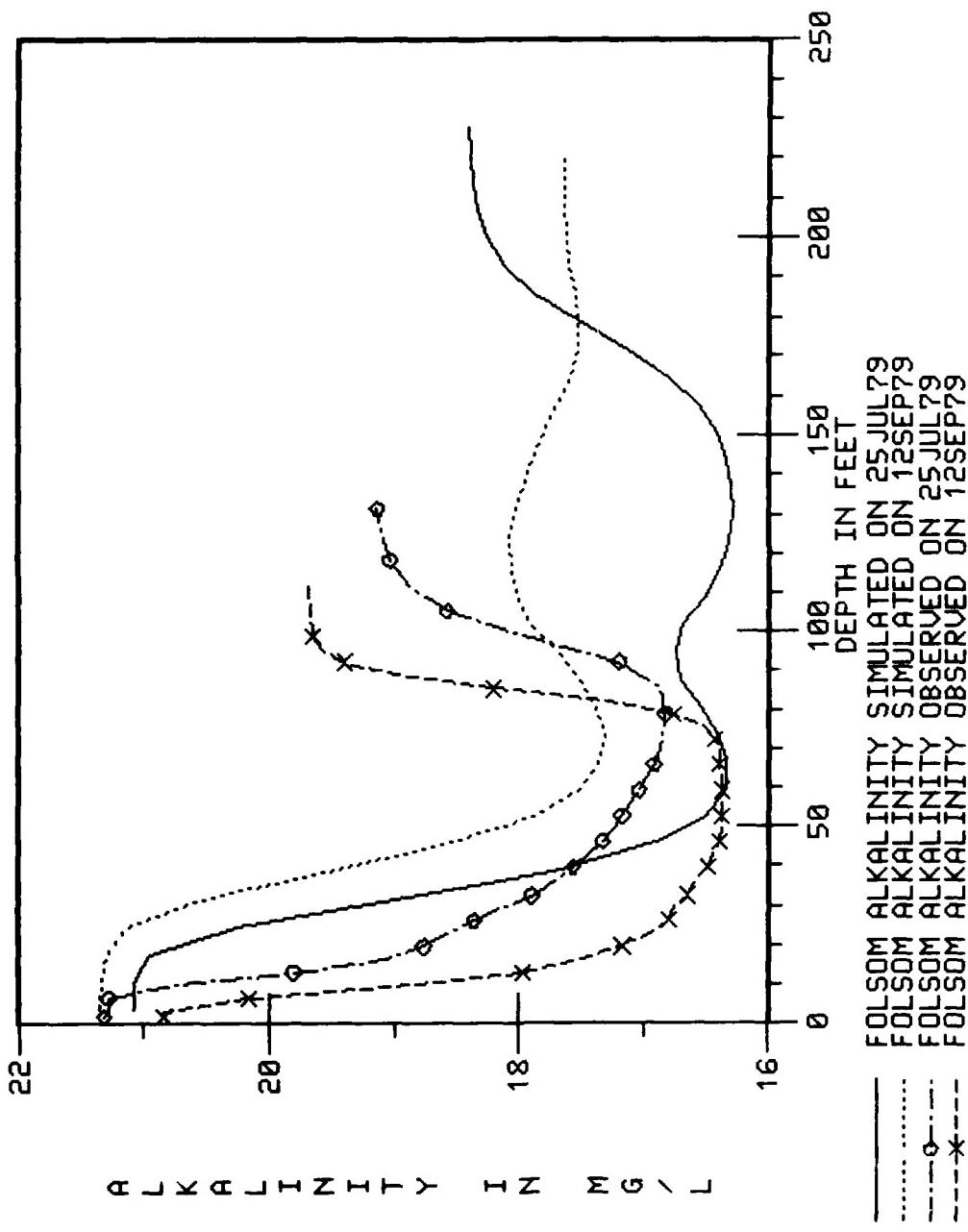


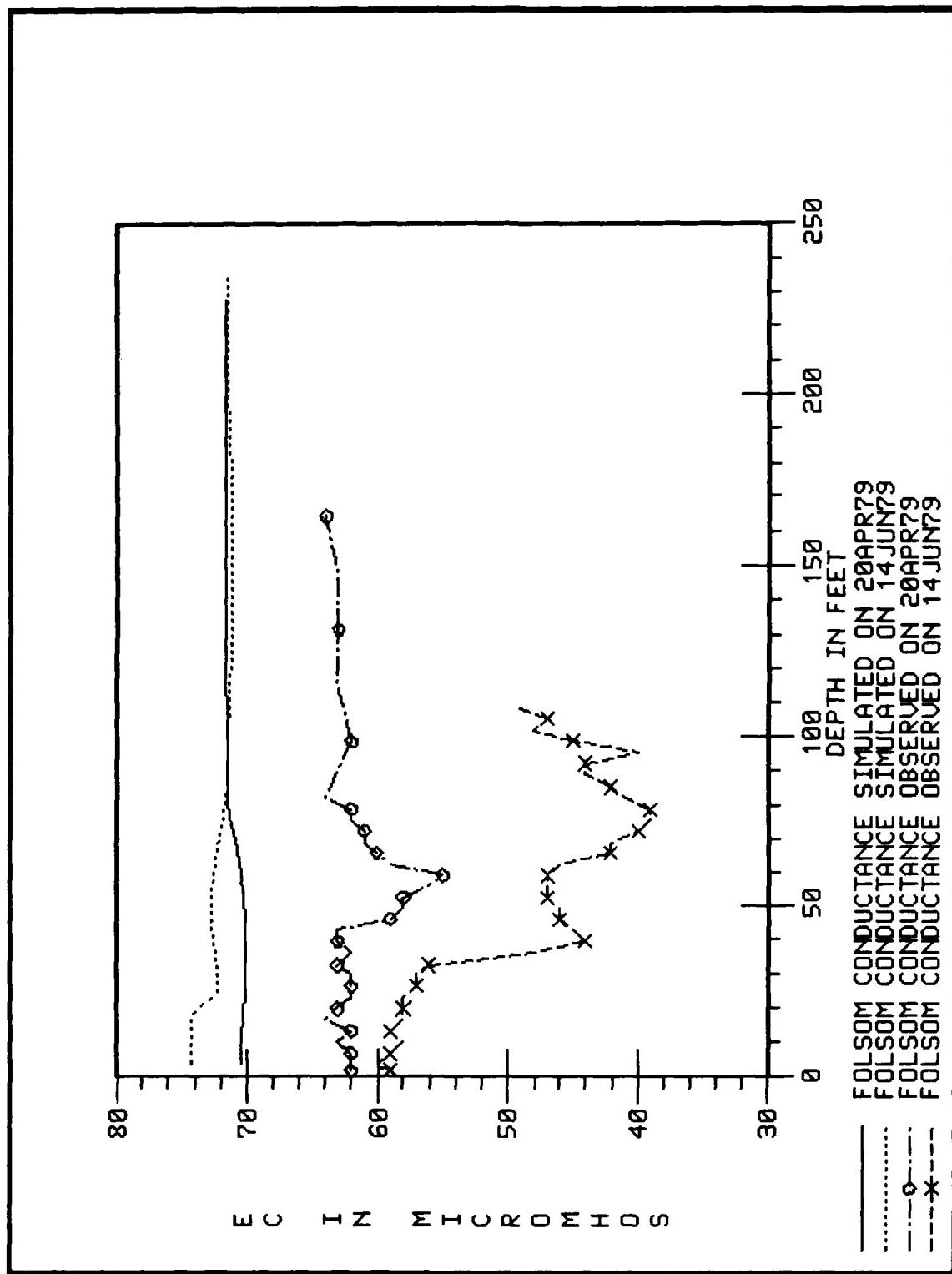


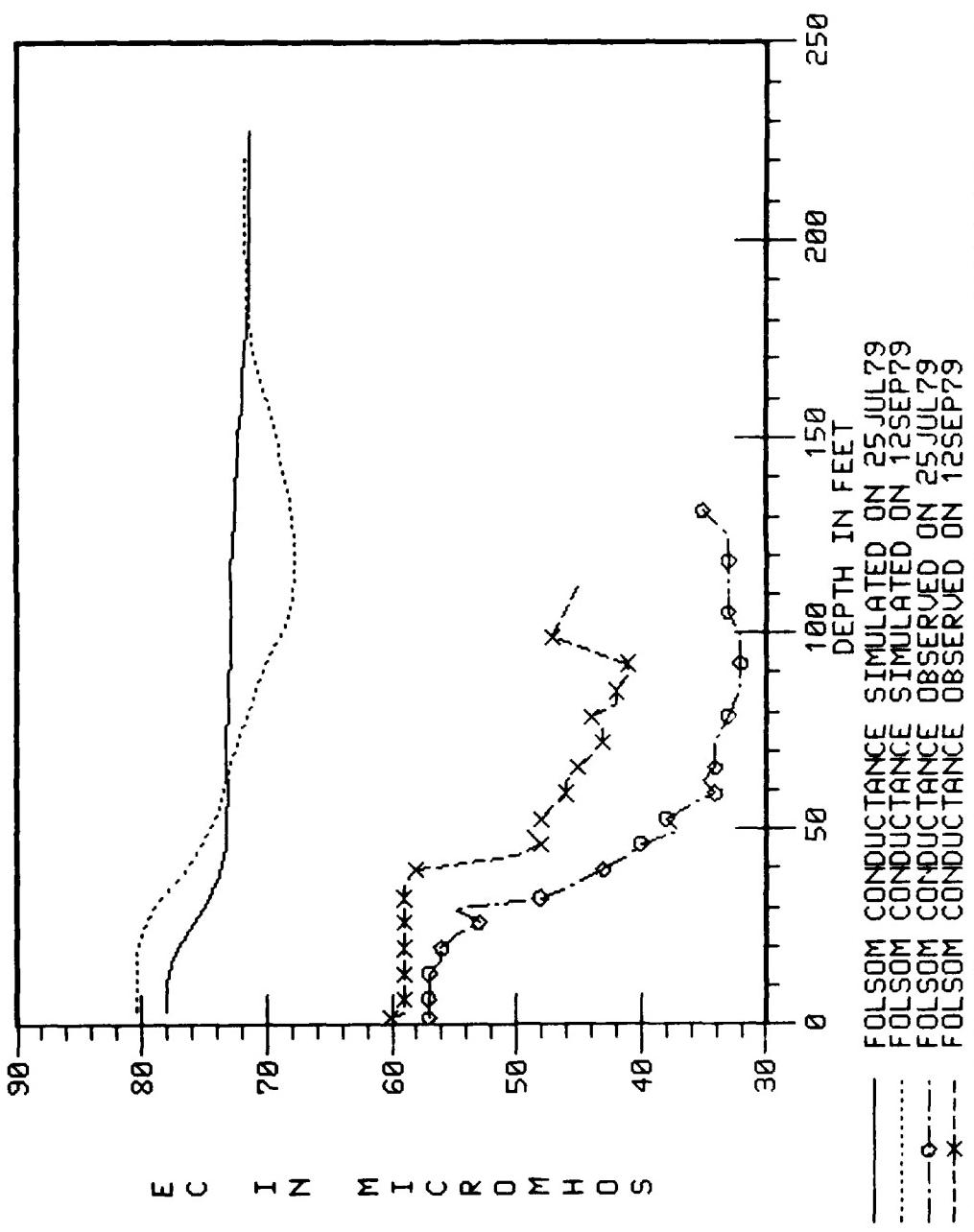


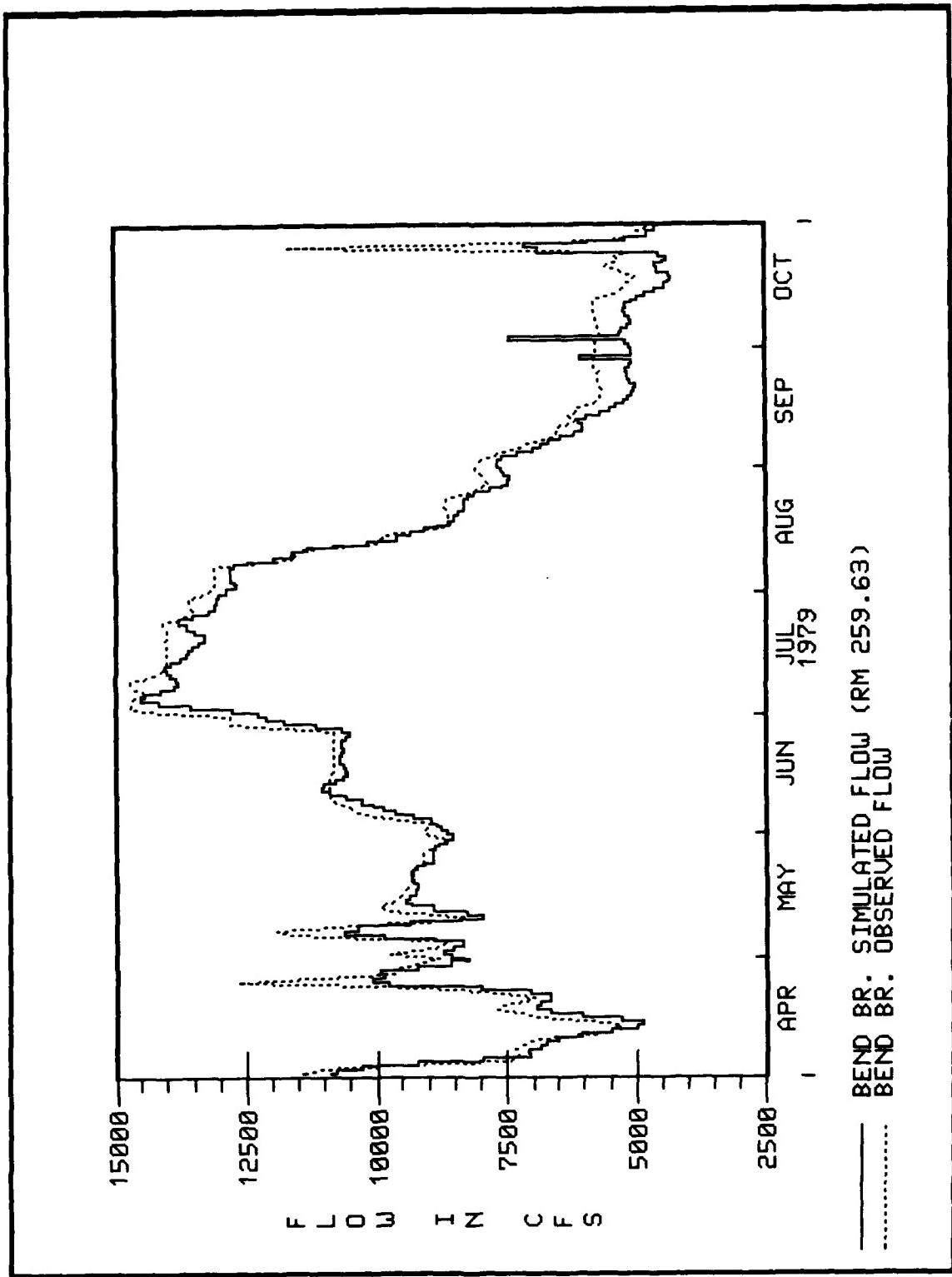


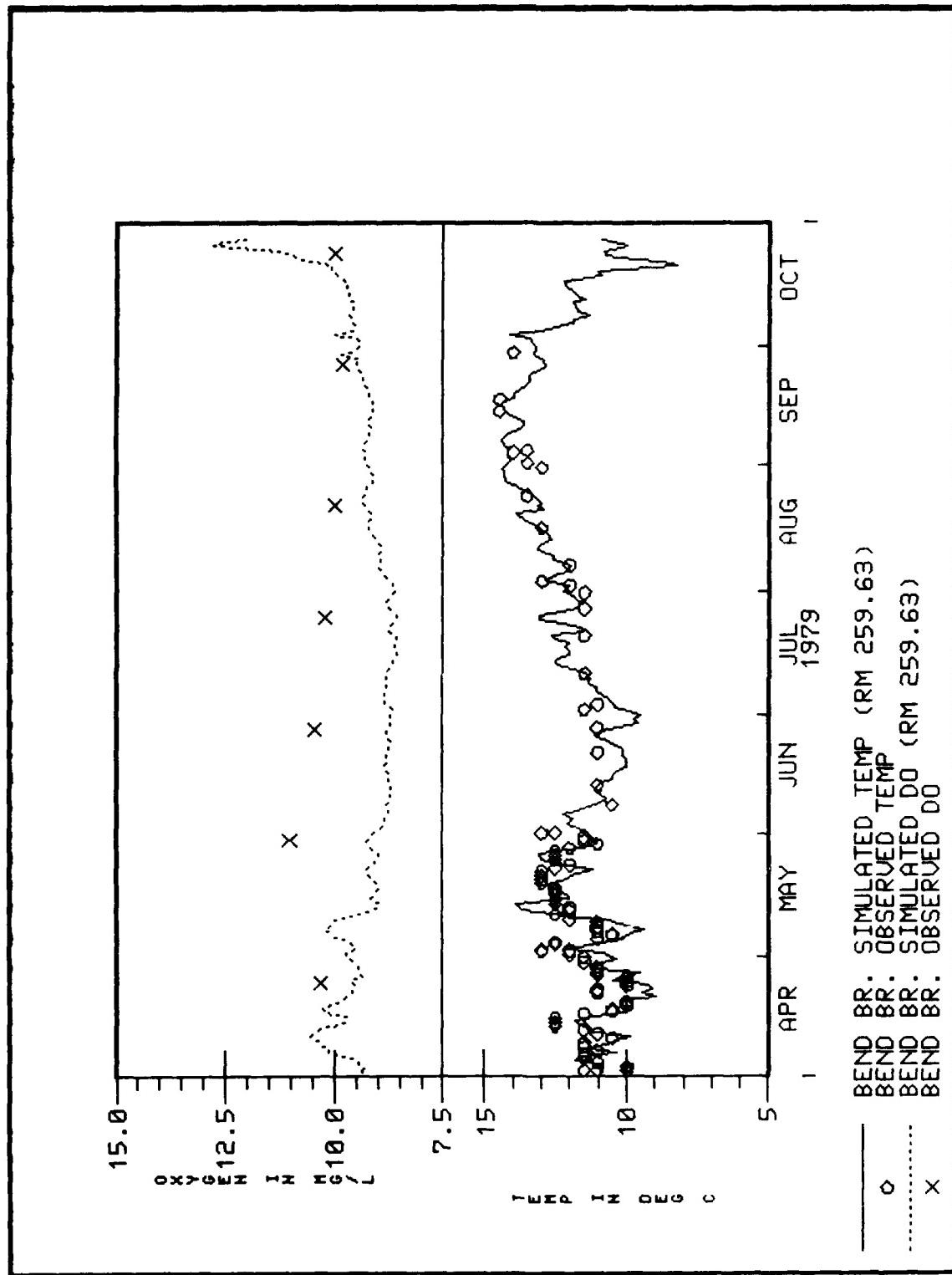


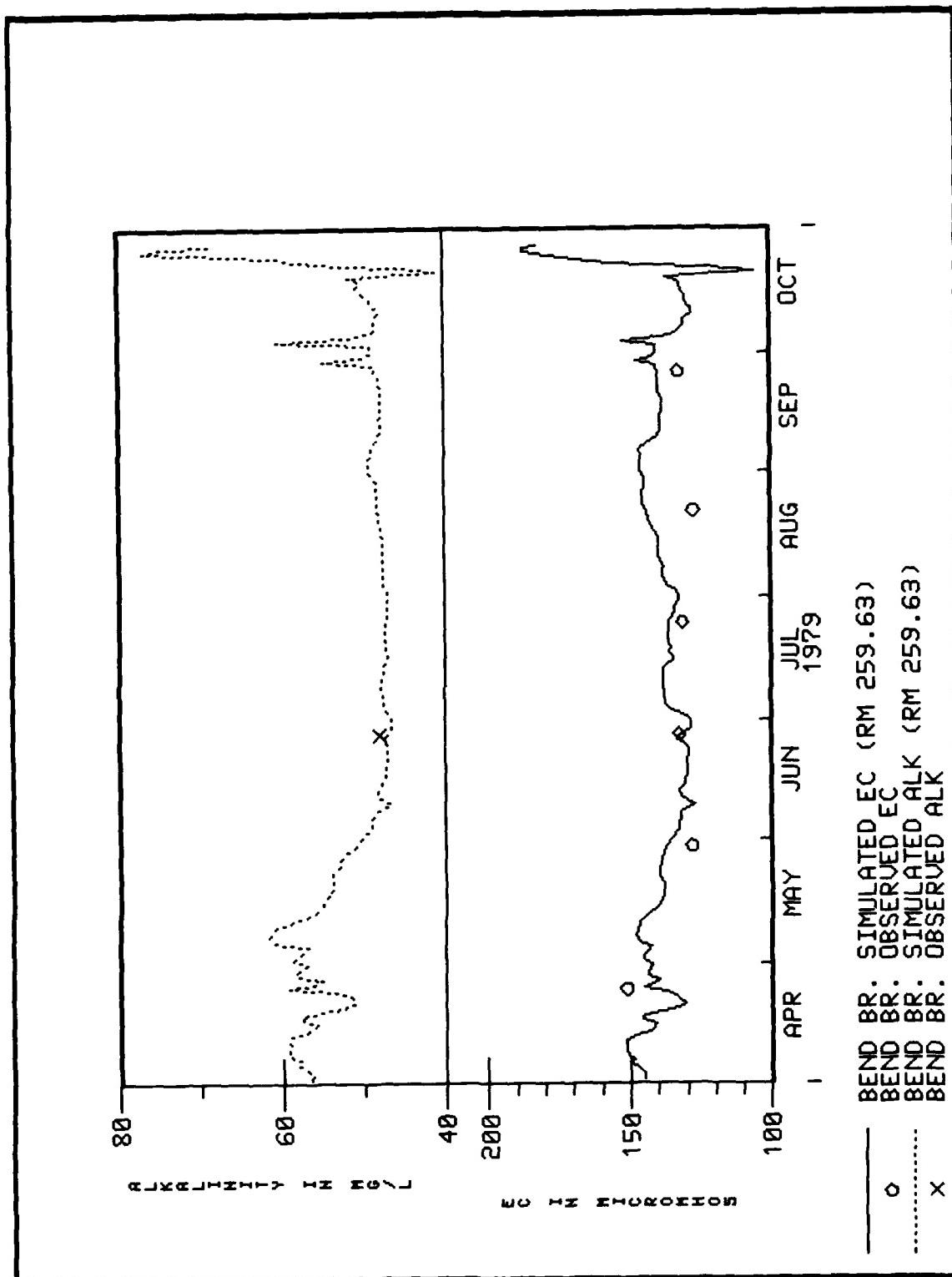


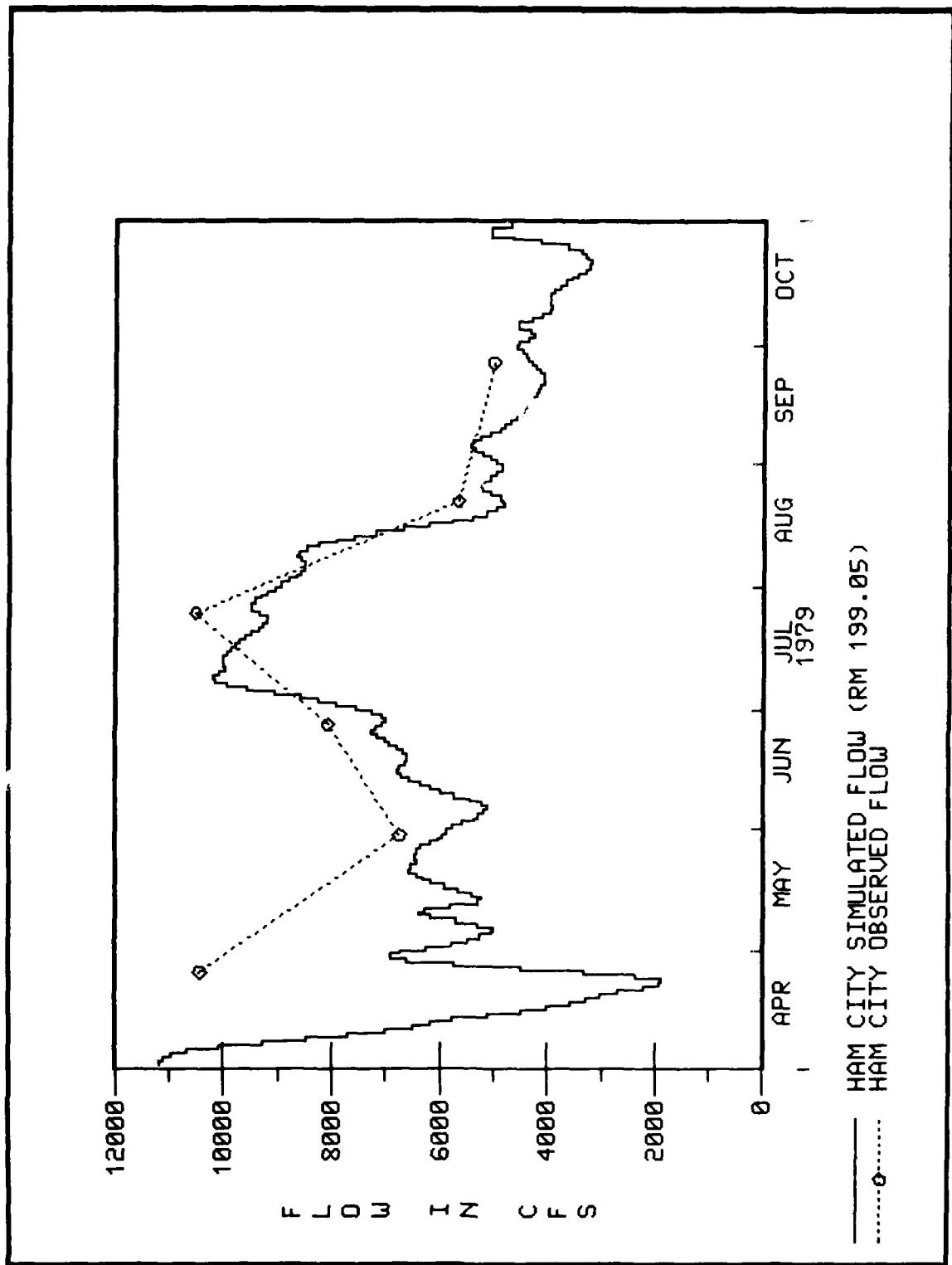


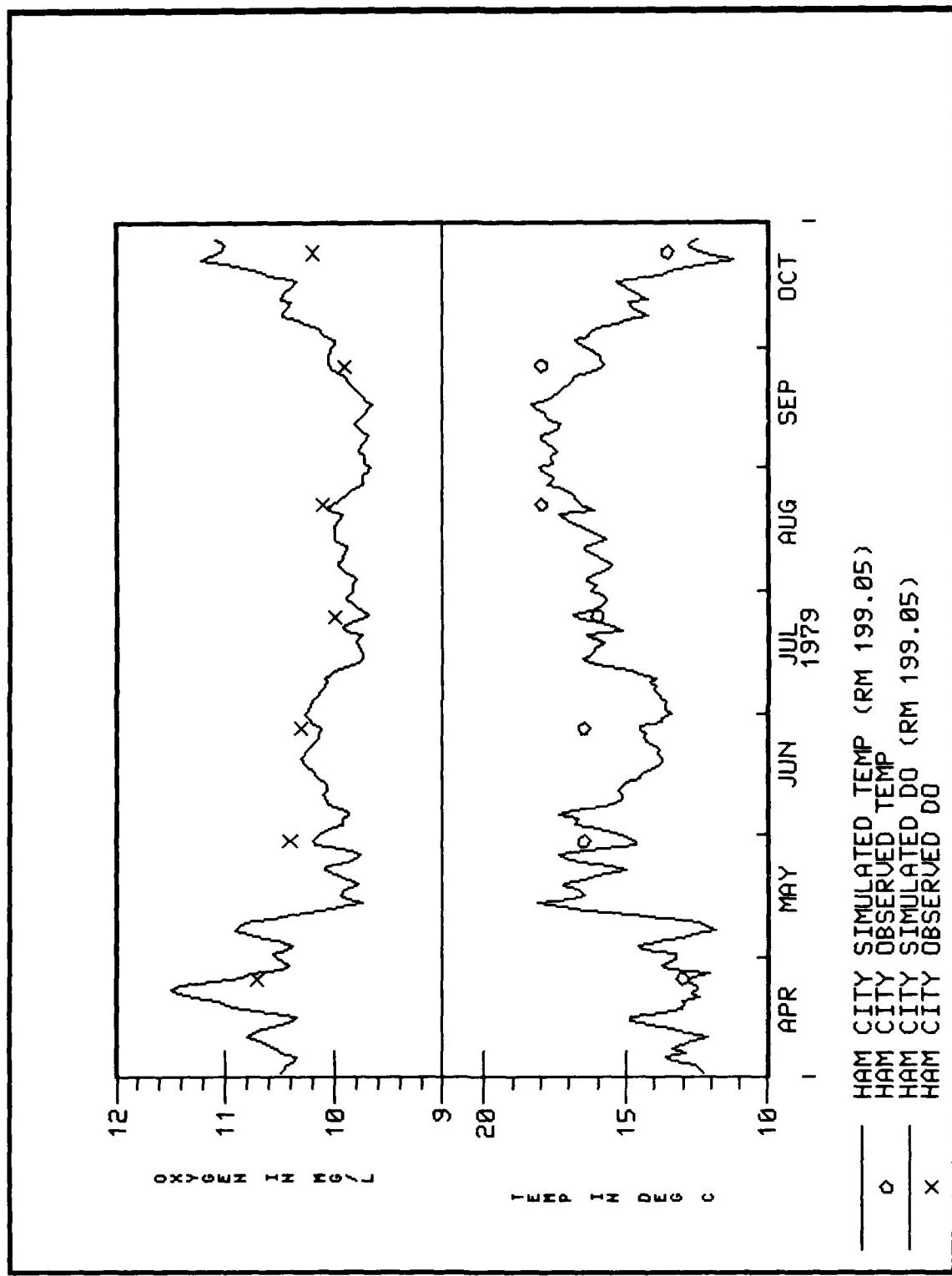


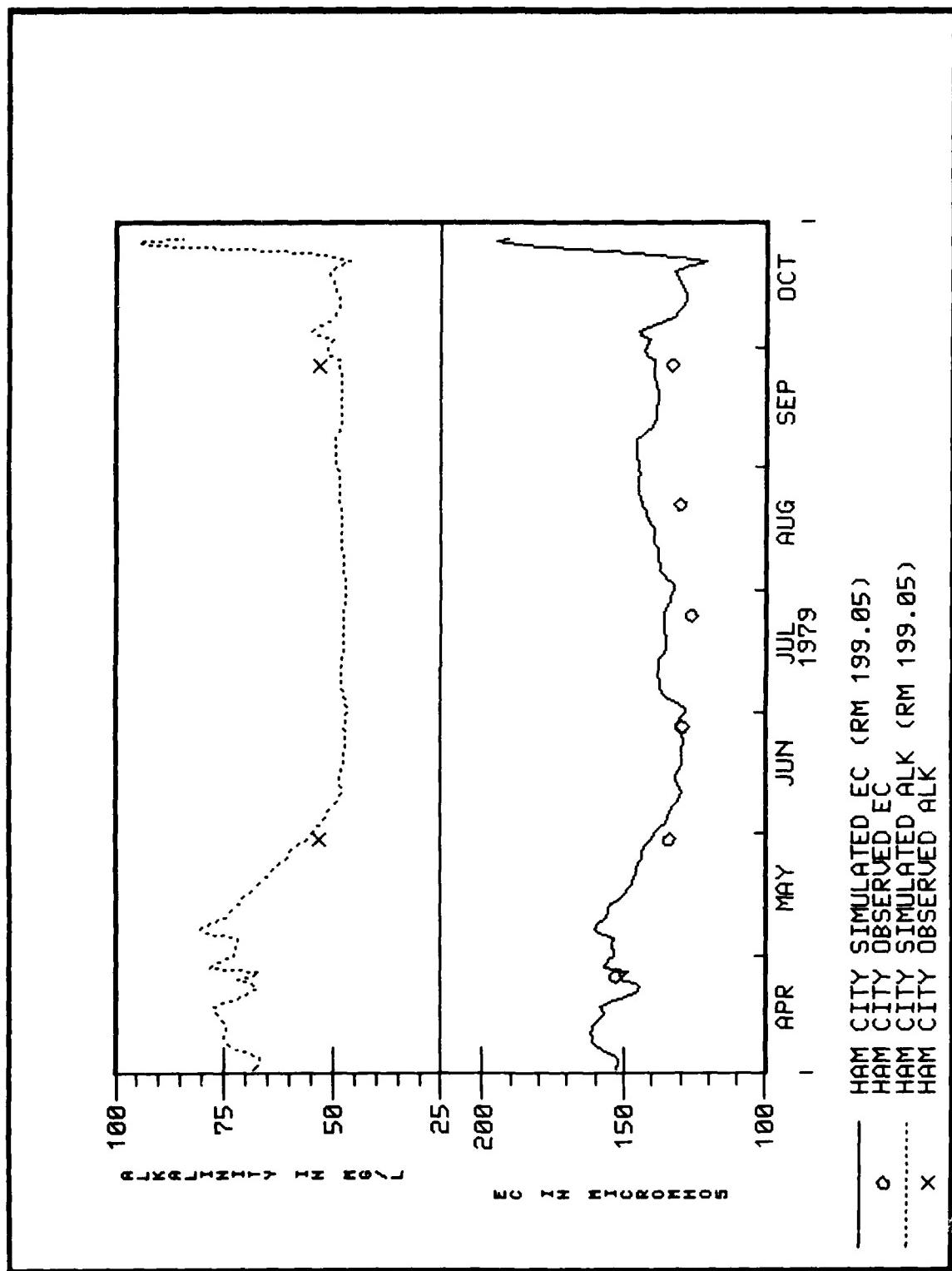


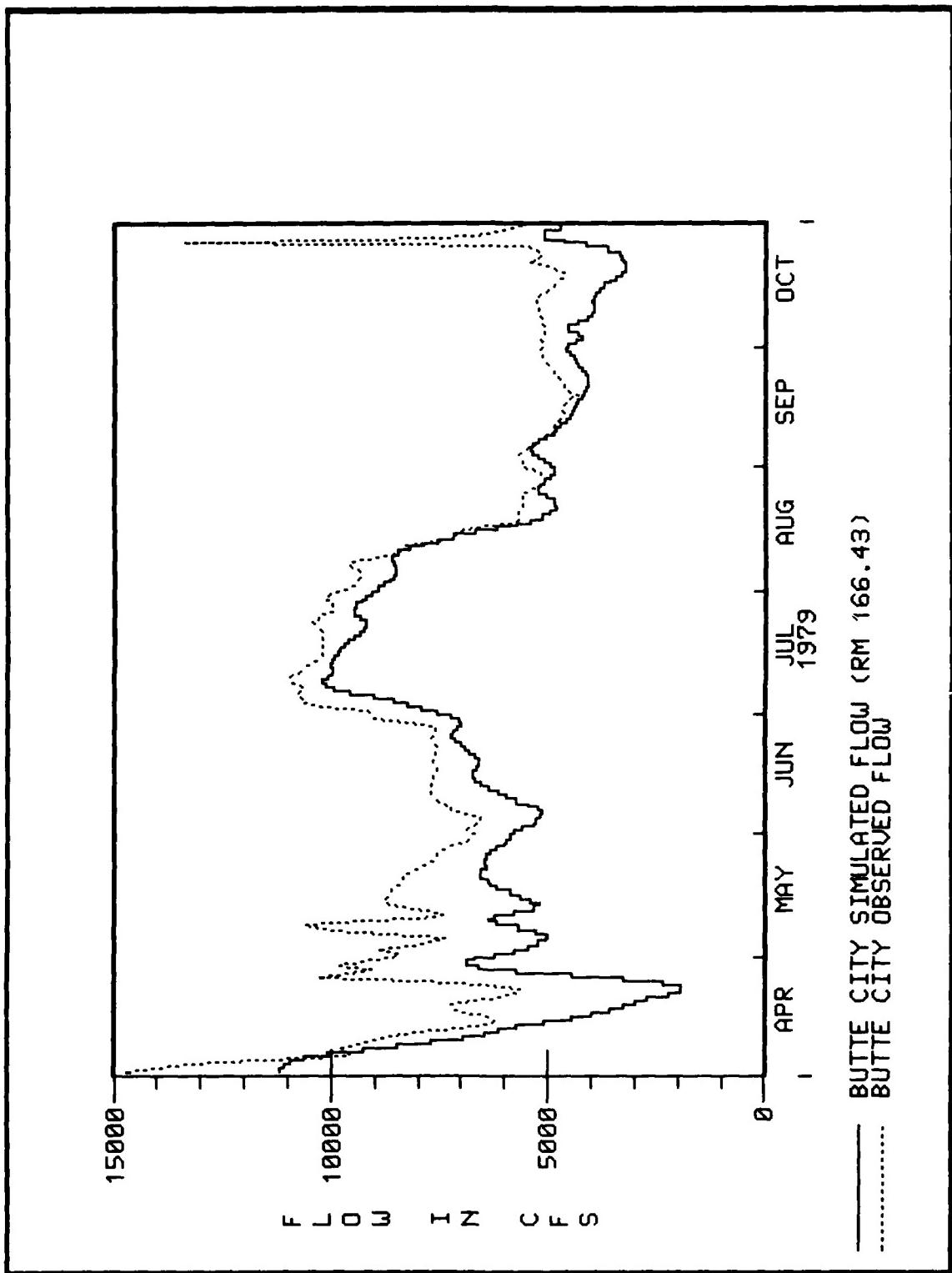


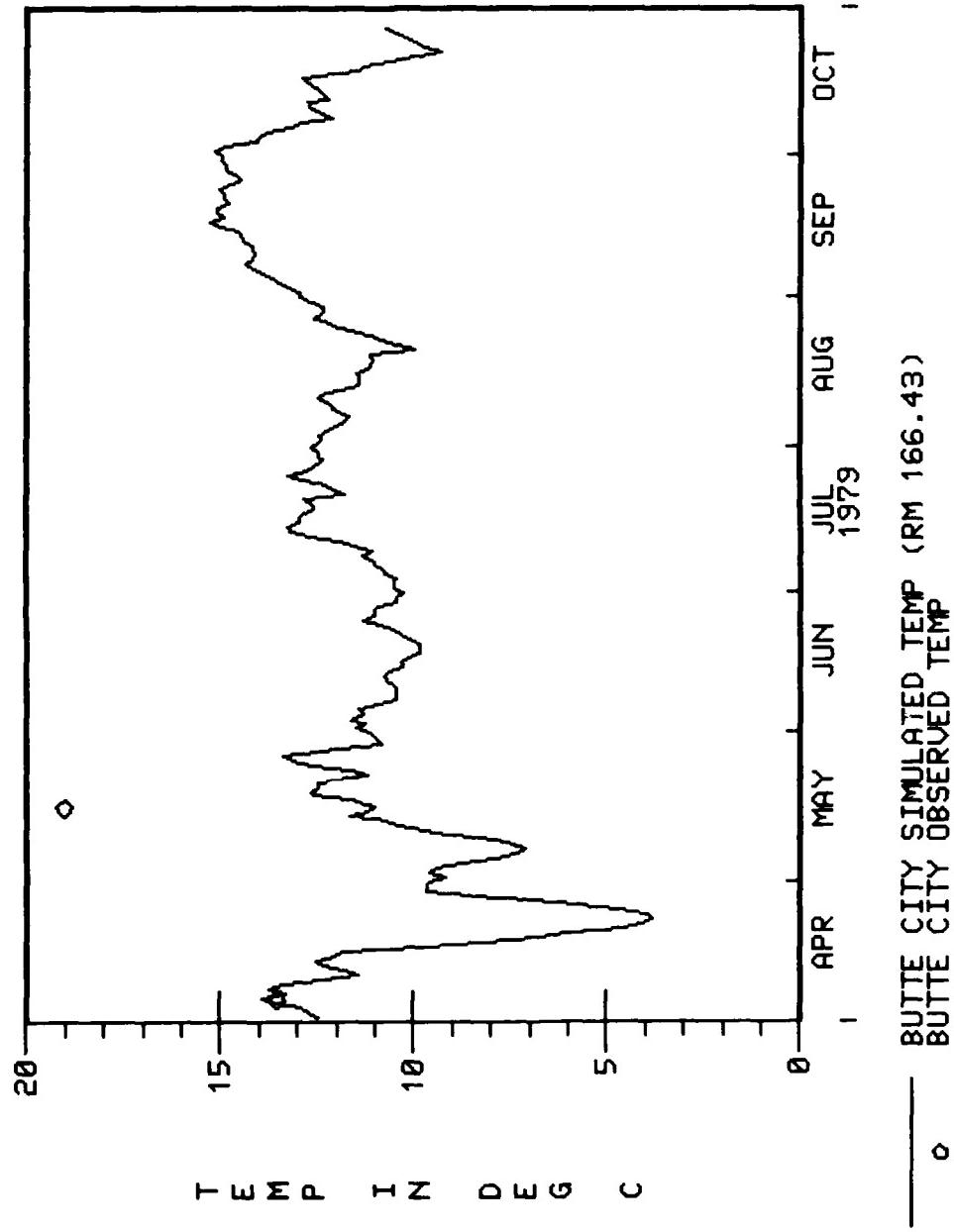


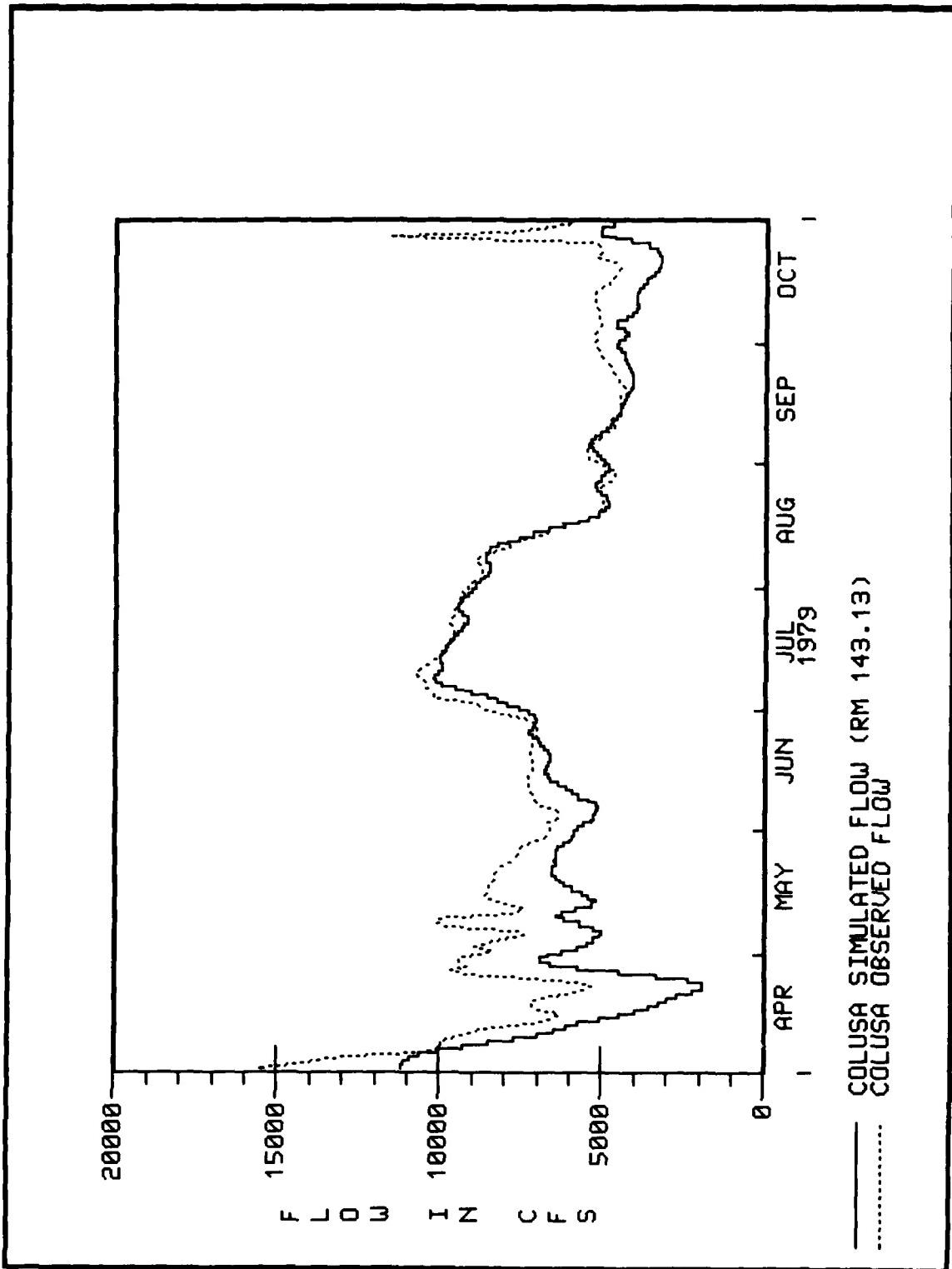


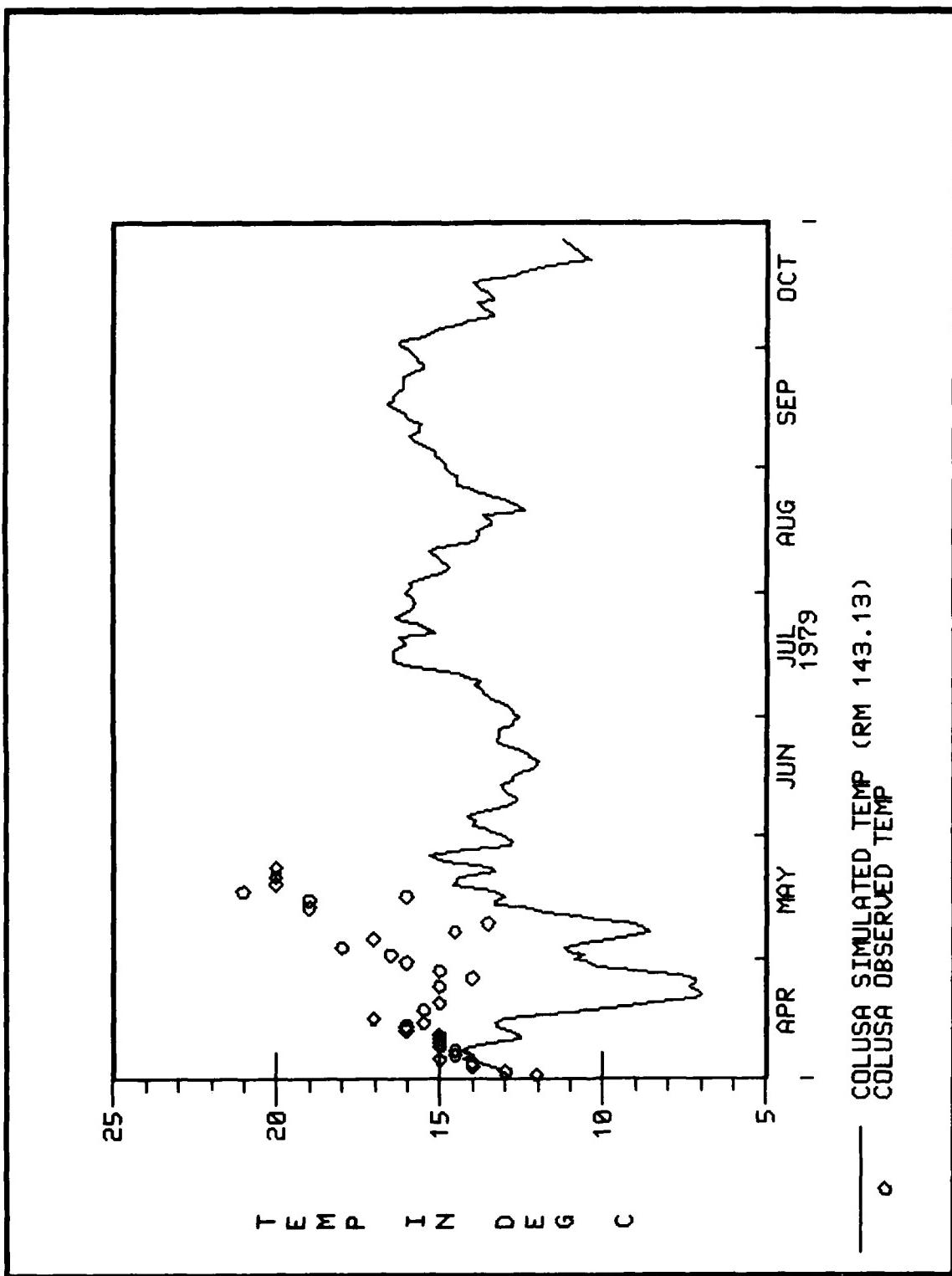


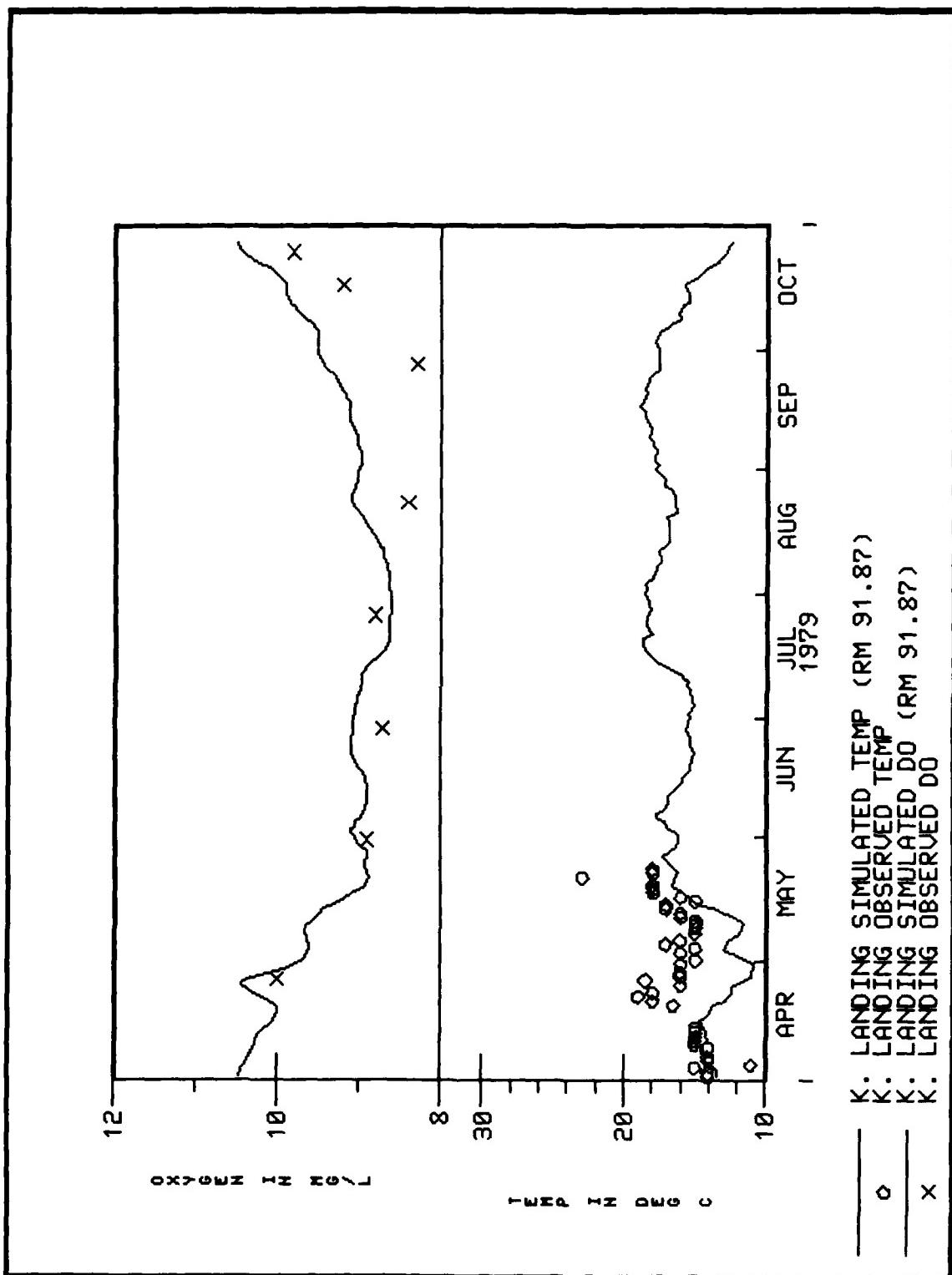


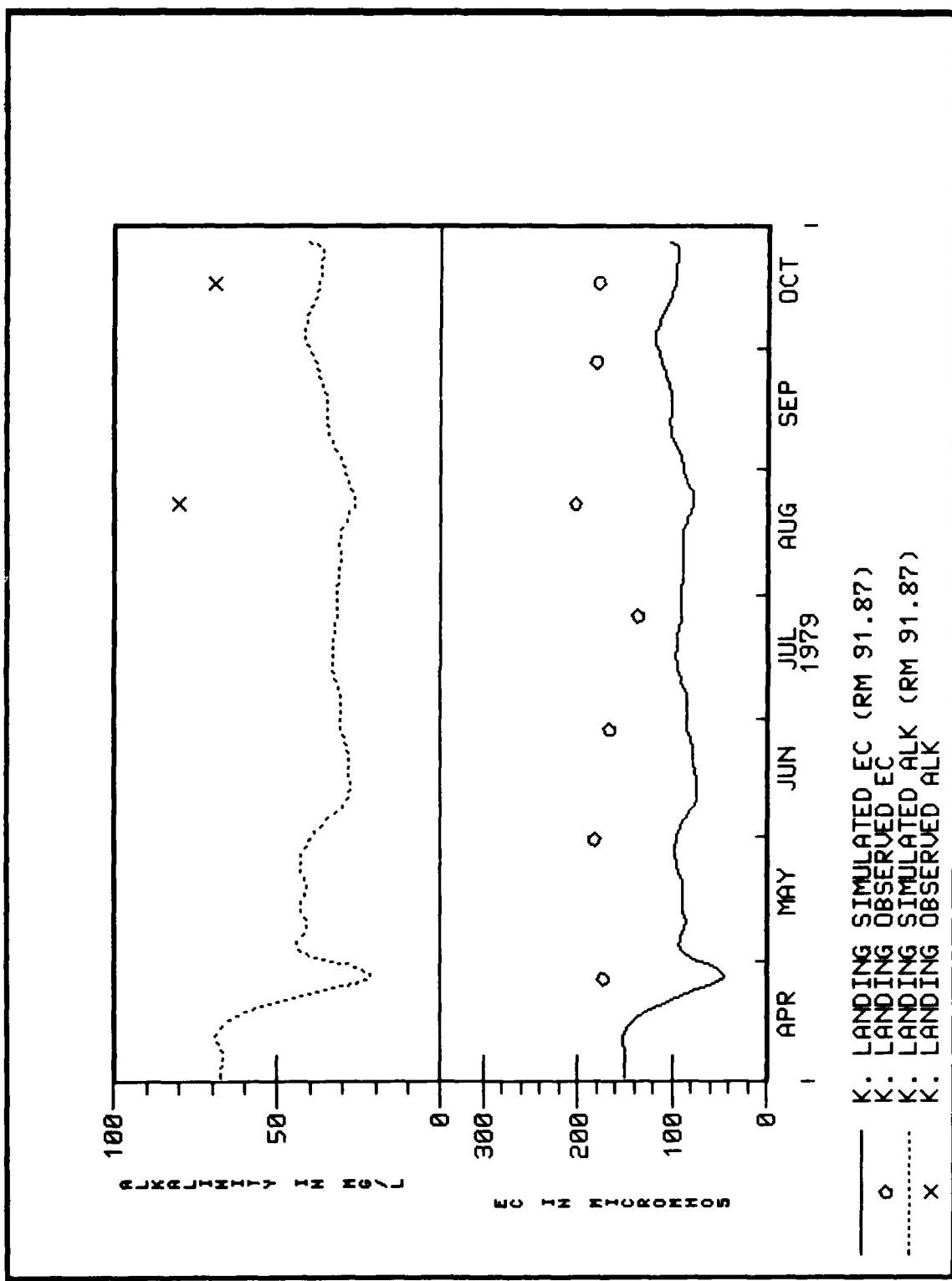


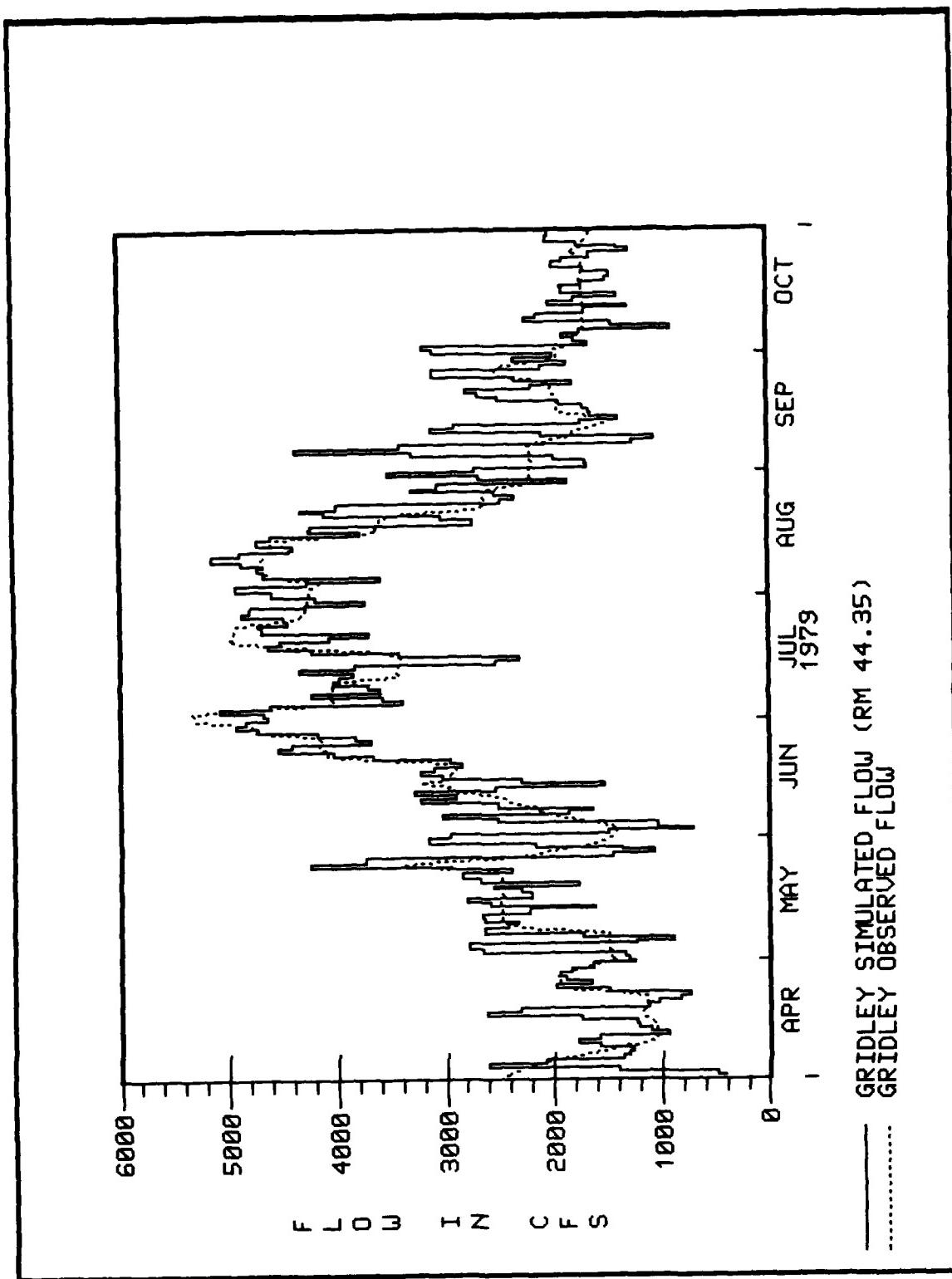


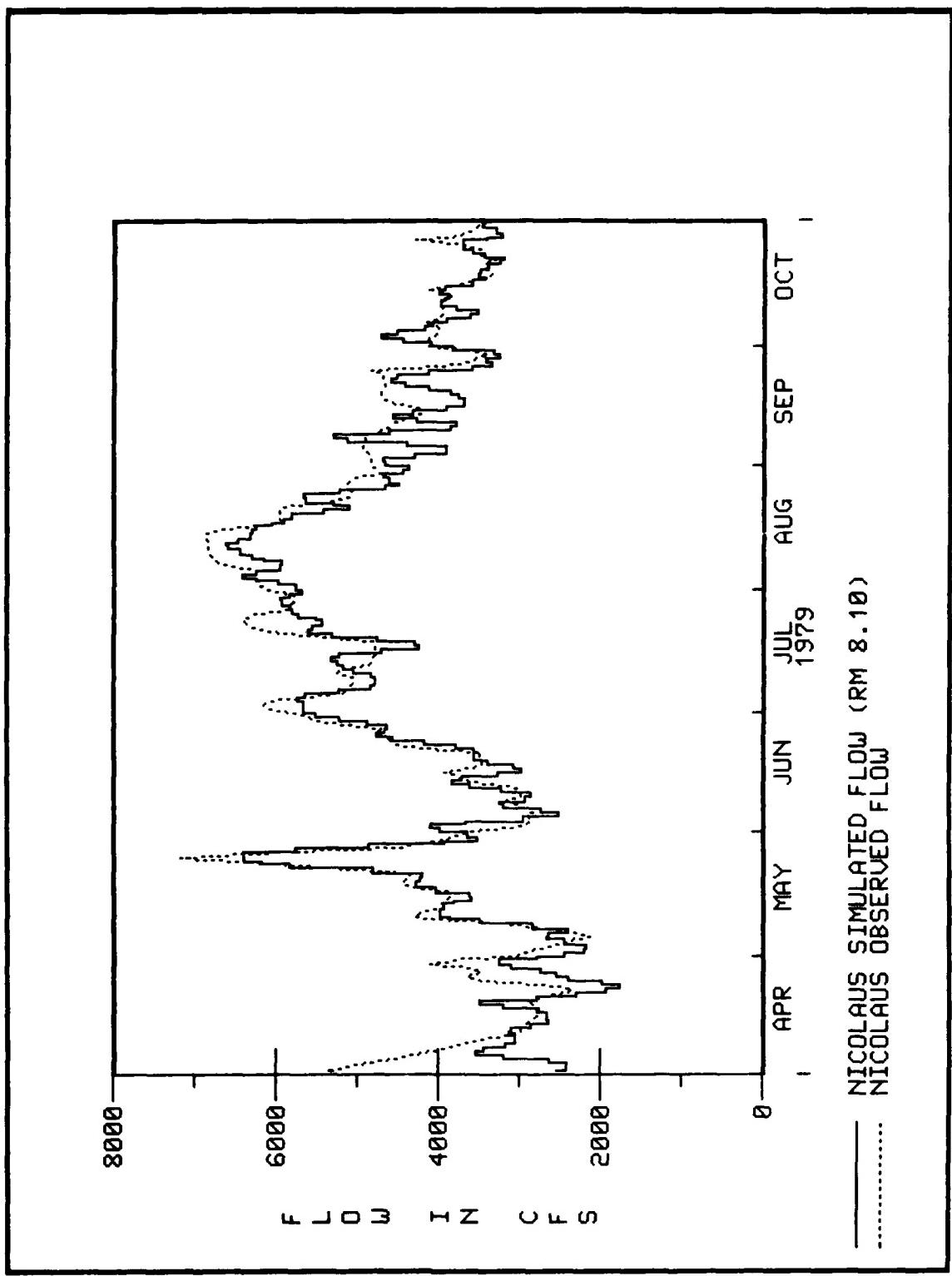












REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Training Document No. 24	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) WATER QUALITY MODELING OF RESERVOIR SYSTEM OPERATIONS USING HEC-5		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This training document was written to assist users of computer program HEC-5, Simulation of Flood Control and Conservation Systems in water quality applications. This document supplements the program Users Manual, which is the basic documentation for the program. In addition to a brief description of the water quality version of the HEC-5 model, this document also includes descriptions of application procedure, data requirements, and example program input and output.		